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BLISTER-RUST WORK

IN THE FAR WEST

January 1 to December 31, 1929.

Spokane Branch
Office of Blister-Rust Control
618 Realty Building
Spokane, Washington

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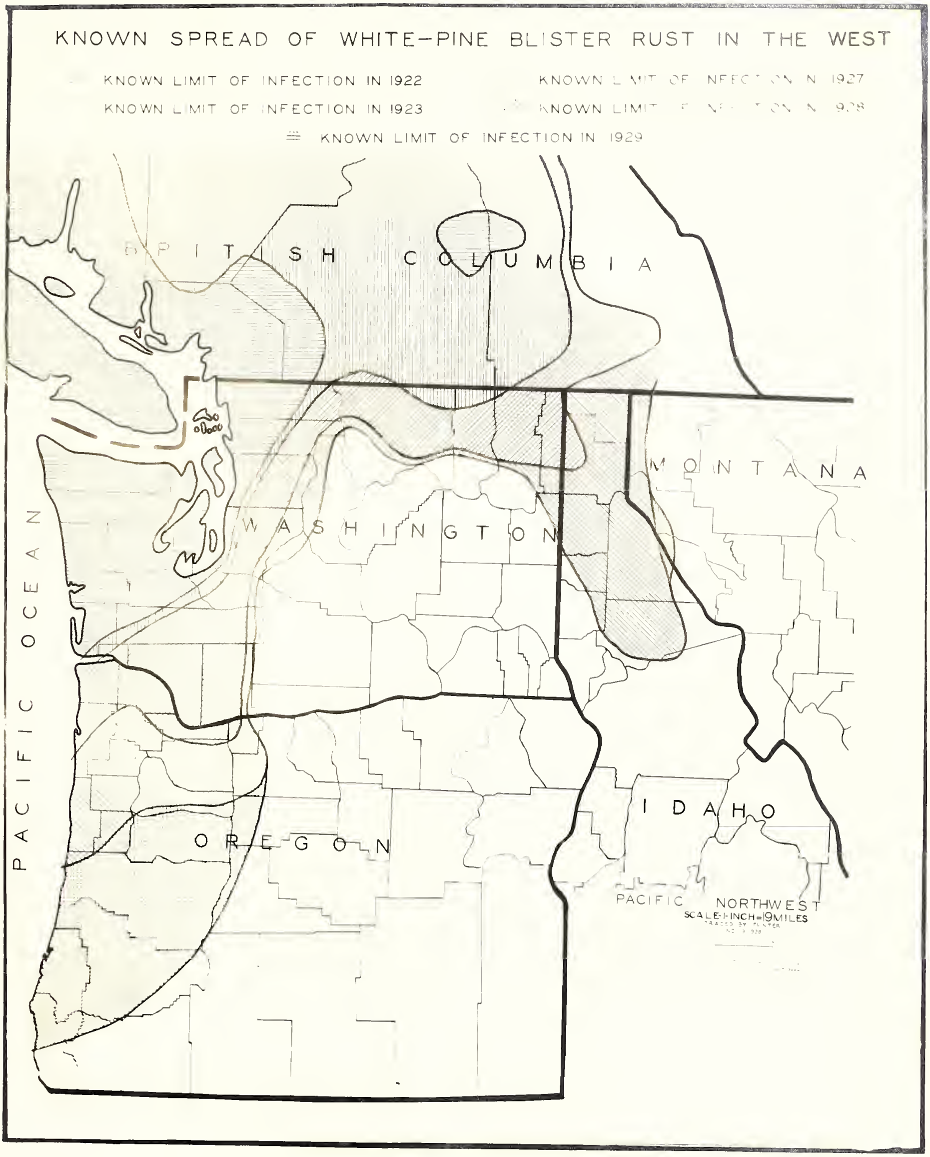
KNOWN SPREAD OF WHITE-PINE BLISTER RUST IN THE WEST
KNOWN LIMIT OF INFECTION IN 1922
KNOWN LIMIT OF INFECTION IN 1923
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KNOWN LIMIT OF INFECTION IN 1929
BRITISH COLUMBIA
WASHINGTON
MONTANA
IDAHO
OREGON
PACIFIC OCEAN
PACIFIC NORTHWEST
SCALE-1 INCH=19 MILES

BLISTER RUST WORK IN THE FAR WEST

January 1 to December 31, 1929.

* * * * * *

INTRODUCTION

The year 1929 was important in the western blister-rust control work because of three outstanding developments. The first of these is the discovery of pine infection at several points in north Idaho, the second is the realization of the importance of stream-type eradication as an initial attack upon the disease, and the third is the undertaking of stream-type eradication on a cooperative basis with two of the most prominent timber protective associations of the Idaho white-pine type.

The discovery of pine infection centers in north Idaho occurred during the field season of 1929. Four such points were located, the details of these areas being given in the body of this report. Of importance, however, is the fact that these infection areas corroborated the evidence secured at Newman Lake, Washington, and showed a wide sweep of infection over the Idaho white-pine belt in 1923. To a limited extent this has been followed by local intensification of pine infection in 1926 and 1927. It is obvious, however, that further intensification has been steadily going on and that the first favorable season for rust dissemination in the future will see a dangerous extension of pine infection in north Idaho.

With the development of a program of initial stream-type eradication the general program of blister-rust control in north Idaho received an important impetus. The completion of stream-type eradication is of particular value for the initial reason that it represents a direct and sharp blow at the greatest point of infective power in the white-pine type and also that it constitutes a very definite and concrete objective toward which cooperative control can be most effectively directed for several years to come. This development permits a program which will be highly effective in combating the rust and at the same time gives a high degree of elasticity in undertaking the second phase of general control, Ribes eradication in the upland types.

During the spring of 1929 the Clearwater and Potlatch Timber Protective Associations stated their willingness to undertake stream-type eradication upon a cooperative basis. As the plan was finally matured, Federal financial cooperation was given to these two associations in the proportion of two dollars of Federal money to one dollar of private money. During the process of the negotiations with the associations a

[illegible]

[illegible]

INTRODUCTION

The year 1930 was [illegible] in the [illegible] control work because of [illegible] developments. [illegible] these is the discovery of pine infection [illegible] in north Idaho, the second is the realization of [illegible] eradication as an initial attack upon the disease, [illegible] undertaking of stream-type eradication on [illegible] of the most prominent [illegible] of [illegible] white-pine type.

The discovery of pine infection [illegible] occurred during the field season of 1930. [illegible] the details of these areas being given in [illegible] of this report. Of importance, however, is the fact that [illegible] corroborated the evidence secured [illegible], [illegible] wide sweep of infection over the Idaho [illegible] limited extent [illegible] been followed by [illegible] infection in 1927 and 1929. It is obvious, however, [illegible] intensification [illegible] been [illegible] season for rust dissemination in the future will [illegible] extension of [illegible] infection in north Idaho.

With the development of [illegible] eradication [illegible] general program of [illegible] control in north Idaho received an important impetus. [illegible] stream-type eradication is of particular value [illegible] initial attack [illegible] direct [illegible] sharp blow at the disease [illegible] white-pine type and also [illegible] concrete objective [illegible] effectively directed [illegible] years to come. [illegible] a program which will [illegible] the same time gives a high degree of [illegible] phase of general control, [illegible].

During the season of 1930 [illegible] Protective Association [illegible] type eradication upon a cooperative basis. [illegible] matured, federal financial cooperation [illegible] in the proportion of two dollars of [illegible] money. [illegible]

Federal cooperative policy took form which will insist upon the following points in the cooperative work:

(1) That reproduction as well as mature timber stands should be protected.

(2) That the stream-type eradication work in any locality should proceed in an orderly fashion upon the basis of drainages and irrespective of local ownership. If the associations are to receive this degree of Federal assistance it is incumbent upon them to straighten out any difficulties which may arise due to mixed land ownership so that the duty of this Office will be only to apply the proper and necessary control measures over the entire areas selected. The effect of this degree of cooperation and of this policy has been that the private timber owners have subscribed their share of the money for the operation but have secured this money from the larger operators rather than from the holders of small parcels of land which may be interspersed through their holdings. And they have been willing to do this in order to receive and hold the high degree of Federal cooperation. The system has thus far been particularly successful in that it has prevented any breaking up of the actual field work according to highly recognized differences in land ownership. These two associations have signified their willingness to continue these cooperative relations in the future and in accordance with their recent request this office is now preparing a general working plan for blister-rust control in these two and in the Priest Lake Timber Protective Association.

The State of Idaho has been a party to this cooperative work by means of an appropriation made in the last legislature of $10,000.00 for blister-rust control. These state funds have been expended as the state's prorated share as a land owner in each of the two associations concerned. The effect of this method of organization has been that the timber protective associations, rather than the state itself, appear directly as the cooperator.

The activities of the Western Branch of the Office of Blister-Rust Control for the calendar year 1929, the period covered by this report, were conducted from funds available for two Federal fiscal years as shown below:

From January 1, 1929 to June 30, 1929, the applicable appropriation was "39133.14, Salaries and Expenses, Bureau of Plant Industry, Blister-Rust Control, 1929" in the amount of $233,500.00 (for the entire fiscal year 1929) allotted as follows:

Federal cooperative policy [illegible] the following points in the cooperative work:

(1) That reproduction as well as mature [illegible] be protected.

(2) That the blister-rust control should proceed in an orderly fashion upon the basis of [illegible] irrespective of local cooperation. If the [illegible] this degree of Federal assistance it is incumbent upon [illegible] straighten out any difficulties which may arise [illegible] ownership so that the work of this Office will be able to [illegible] proper and necessary control measures over all of the area [illegible]. The effect of this degree of cooperation and of the [illegible] that the private timber owners have subscribed their [illegible] money for the operation [illegible] operators rather than [illegible] the members of small [illegible] may be interested through their [illegible] to do this in order to [illegible] cooperation. The [illegible] in that it may [illegible] according to highly recognized differences in [illegible]. These two associations have [illegible] cooperative relations in [illegible] request this office is [illegible] must control in these [illegible] Association.

The State of Idaho has been [illegible] by means of an appropriation made in the [illegible] for blister-rust control. These [illegible] states protects [illegible] concerned. The effect of this [illegible] timber protective association [illegible] directly to the cooperators.

The activities of [illegible] Rust Control for the calendar year [illegible] were conducted from funds available [illegible] shown below:

From January 1, 19[illegible] to June 30, 19[illegible] tion was "$29136.14, [illegible] Blister-Rust Control, 19[illegible] fiscal year 1929) allotted as follows:

Project	For the Period 7/1/28 to 6/30/29
A. Delaying spread of blister rust	
1. Eradication of cultivated black currants in Montana, Washington and California..................$	7,930.86
2. Field surveys and inspection of nurseries in Oregon..	700.00
3. Field surveys in northwestern states to determine location of dangerous centers of pine infection and to follow the natural advance and establishment of blister rust in the northern area..................	11,695.65
B. Development and application of local control	
1. National forests of northeastern Washington, Idaho and northwestern Montana....................	62,222.32
2. Local control on state and private lands, dollar for dollar cooperation between Federal Government and timber owners......................	4,200.00
3. Control reconnaissance in Idaho, Montana and northeastern Washington.........................	21,000.00
4. Studies of local control and its costs in California..	11,000.00
5. Control reconnaissance and Ribes survey, California sugar-pine areas........................	5,500.00
6. Studies of local control and recheck of previously eradicated areas, Oregon.................	4,000.00
C. Investigational work, Office of Forest Pathology.........	21,500.00
D. Experimental work on chemical eradication and studies on Ribes ecology..	26,923.32
E. Educational work..	5,945.85
F. Field supervision, maintenance of Spokane Office, Miscellaneous supplies............................	23,900.00
G. Miscellaneous	
General control..................$20,080.00	
Plant Disease Survey........... 500.00	
2% Department Reserve.......... 4,268.00	
1% Bureau Reserve.............. 2,134.00	26,982.00
Total.....................................	$233,500.00

From July 1, 1929 to December 31, 1929, the applicable appropriation was "30133.14, Salaries and Expenses, Bureau of Plant Industry,

Blister-Rust Control, 1930" in the amount of $238,195.00 (for the entire fiscal year 1930) allotted as follows:

Project		For the period 7/1/29 to 6/30/30
A. Delaying spread of blister rust		
1. Eradication of cultivated black currants in California		$ 7,000.00
2. Field surveys in northwestern states to determine location of dangerous centers of pine infection and to follow the natural advance and establishment of blister rust in the northern area		8,725.00
B. Development and application of local control		
1. National forests of northeastern Washington, Idaho and northwestern Montana		37,162.00
2. Local control on state and private lands, two dollars for dollar cooperation between Federal Government and timber owners		40,000.00
3. Studies of local control and its costs in California		18,643.00
4. Control reconnaissance and Ribes survey, California sugar-pine areas		5,800.00
5. Studies of local control and recheck of previously eradicated areas, Oregon		8,000.00
C. Investigational work, Office of Forest Pathology		22,155.00
D. Experimental work on chemical eradication and studies on Ribes ecology		32,180.00
E. Educational work		6,785.00
F. Field supervision, maintenance of Spokane Office, Miscellaneous supplies		25,000.00
G. Miscellaneous		
General control	$19,710.00	
Mycology	540.00	
2% Departmental Reserve	4,330.00	
1% Bureau Reserve	2,165.00	26,745.00
Total		$238,195.00

The present organization of the Western Branch of the Office of Blister-Rust Control partakes largely of a close centralization in which the work is all organized under direct supervision of the Spokane Office. The majority of the project leaders are permanently headquartered in Spokane. This system is altered only in the case of the state leaders for Montana, Oregon and California, who are headquartered in those states, and in the case of certain project leaders, whose

Blister-rust Control, 1930 in the amount of [illegible] for the entire fiscal year 1930 [illegible] as follows:

Project	[illegible]
A. [illegible] spread of blister rust	
1. Eradication of cultivated [illegible] California [illegible]	[illegible]
2. [illegible] surveys in northwestern states [illegible] location of [illegible] to follow the [illegible] blister rust [illegible]	[illegible]
B. Development and application of local control	
1. National forests of northwestern [illegible] Idaho and northwestern [illegible]	[illegible]
2. Local control on state [illegible]	[illegible]
3. Studies of local control [illegible] California [illegible]	[illegible]
4. Control reconnaissance [illegible] sugar-pine areas [illegible]	[illegible]
5. Studies of local control [illegible]	[illegible]
C. Investigational work, [illegible]	[illegible]
D. [illegible] ecology [illegible]	[illegible]
E. [illegible]	[illegible]
F. Field supervision, [illegible] supplies [illegible]	[illegible]
G. Miscellaneous	
General control [illegible]	[illegible]
Mycology [illegible]	[illegible]
[illegible]	[illegible]
[illegible] reserve [illegible]	[illegible]
Total [illegible]	[illegible]

The present organization [illegible] of Blister-rust Control [illegible] which the work is all organized [illegible] Office. The majority of the [illegible] quartered in Spokane. [illegible] state leaders for Montana, [illegible] in those states, and in [illegible]

work is necessarily centered in other places. Even though more and more work is organized locally in the various states, the general supervision to which the state leaders are subject will remain with the Western Branch Office at Spokane, Washington.

The following is the permanent western personnel which was employed during the period covered by this report:

1. Supervisory

a. In charge of Western Branch Office, S. N. Wyckoff, Senior Pathologist.

2. Project Leaders

a. Ribes Ecological Studies. W. A. Rockie, Assistant Pathologist, assisted by J. L. Bedwell, Assistant Pathologist.

b. Experimental Ribes Eradication, Montana. *C. C. Strong, Associate Forester, C. H. Johnson, Assistant Pathologist in immediate charge, assisted by D. W. Nelson, Junior Forester.

c. Experimental Re-eradication, Idaho. *C. C. Strong, Associate Forester, assisted by C. O. Peterson and H. F. Geil, Agents.

d. Cooperative Local Control, Idaho. *C. C. Strong, Associate Forester, assisted by B. A. Anderson, W. G. Guernsey and M. C. Riley, Junior Foresters; H. E. Crossely and G. M. Whiting, Agents.

e. Field Studies in Methods and Equipment. *C. C. Strong, Associate Forester, assisted by P. S. Simcoe, Junior Forester (transferred to Plant Quarantine 10/1/29), J. F. Breakey, B. A. Ganoung and H. E. Swanson (resigned 9/30/29), Agents.

f. Educational Work, R. L. MacLeod, Agent, assisted by Kermit Miller, Agent.

g. Studies on Spread of the Rust and Damage to Pine. H. N. Putnam, Associate Pathologist, assisted by E. L. Joy, Junior Forester, C. M. Chapman, R. E. Myers and F. F. Staat, Agents.

*For purposes of coordination and standardization of the various eradication projects (b, c, d and e) in the Inland Empire white-pine belt, these were all placed under the supervision of C. C. Strong, Associate Forester.

h. Experimental Chemical Eradication. H. R. Offord, Agent, assisted by R. P. d'Urbal, G. R. Van Atta and Mrs. I. E. Webber, Agents.

i. Miscellaneous. Assigned to various projects. W. F. Painter, (resigned 6/10/29), D. R. Payne (resigned 2/28/29), Agents and F. B. Rowe, Junior Forester (resigned 3/11/29).

3. State Leaders

a. Montana, C. H. Johnson, Assistant Pathologist.

b. Oregon, L. N. Goodding, Associate Pathologist, assisted by Miss D. L. Anderson, Agent.

c. California, G. A. Root, Assistant Pathologist, assisted by project leaders W. V. Benedict, Assistant Forest Pathologist (Eradication) with his assistant D. R. Miller, Junior Forester; F. A. Patty, Junior Pathologist (Ribes Ecology); T. H. Harris, Junior Forester (Reconnaissance). Stenographic work performed by Miss M. J. Preitkis, Agent.

4. Clerical Work

Roy Calhoun, Junior Administrative Assistant, assisted by A. H. Glasgow, Agent.
Miss M. L. McWold, Senior Clerk and Temporary Special Disbursing Agent, assisted by Mrs. M. C. Dowdy, Clerk and Mrs. E. M. Jump, Junior Clerk.
Mrs. L. E. Klatt, Clerk-Stenographer.
Miss Catherine Ryan, Junior Clerk-Stenographer.
Miss E. K. Mellon, Junior Typist.
Miss A. M. Fellows, Under Clerk-Typist.

BLISTER-RUST-CONTROL WORK IN MONTANA
1929

Blister-rust-control work in Montana was carried on, as in the past, as a cooperative project between the Montana Department of Agriculture, Montana Forestry Department, School of Forestry, University of Montana, the Northern Montana Forestry Association, the Blackfoot Protective Association and the Bureau of Plant Industry. The basic memorandum of understanding upon which this work was organized was made effective July 1, 1927 and can be found in the report for that calendar year. The following is the amendment to this memorandum to cover the work as organized for the Federal fiscal year 1930, beginning July 1, 1929:

AMENDMENT TO
MEMORANDUM OF UNDERSTANDING
Effective July 1, 1927

Between
THE UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY
and the
MONTANA STATE DEPARTMENT OF AGRICULTURE - - - MONTANA STATE FORESTRY DEPARTMENT - - - THE SCHOOL OF FORESTRY, UNIVERSITY OF MONTANA - - - and the NORTHERN MONTANA FORESTRY ASSOCIATION

Cooperative Work in Controlling White Pine Blister Rust
in
MONTANA
* * * *

Paragraph F-6 of the Memorandum of Understanding described above contains the following:

> "For the fiscal year 1928, the Bureau of Plant Industry shall contribute in value approximately $6,000, the Montana State Department of Agriculture approximately $5,000, the Montana State Forestry Department approximately $1,200, the School of Forestry, University of Montana, approximately $300, and the Northern Montana Forestry Association shall contribute in value approximately $1,000; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence."

In accordance with the foregoing provision, it is mutually agreed that the Blackfoot Protective Association will be added to those agencies who are cooperating to secure the control of white-pine blister rust in Montana and that for the fiscal year ending June 30, 1930, there will be contributed in value by the Montana

State Department of Agriculture approximately $4,000, by the Montana State Forestry Department approximately $1,200, by the School of Forestry, University of Montana, approximately $300, by the Northern Montana Forestry Association approximately $1,000, by the Blackfoot Protective Association approximately $500, and by the United States Department of Agriculture, Bureau of Plant Industry, through its Office of Blister Rust Control, approximately $7,500 in connection with cooperative blister rust control work in Montana.

Date:	Signature:
9/12/29	(s) A. H. Stafford Commissioner, Montana Department of Agriculture
11/8/29	(s) Rutledge Parker State Forester, Montana Forestry Department
11/8/29	(s) Thos. C. Spaulding Dean, School of Forestry, University of Montana
10/14/29	(s) A. E. Boorman Secretary, Northern Montana Forestry Association
11/25/29	(s) Roscoe Haines Secretary, Blackfoot Protective Association
	(s) Wm. A. Taylor Chief, Bureau of Plant Industry

RIBES ERADICATION, SAVENAC NURSERY, HAUGAN, MONTANA

By
C. H. Johnson,
Assistant Pathologist.

The preliminary details, such as location, purpose of project and description of area, were covered in the previous year's report. The organization, methods and accomplishments of the 1929 season are herewith presented.

INTRODUCTION

To protect the Savenac Nursery from blister rust requires the removal of Ribes from 612.4 acres of stream type. During the 1928 season 476.8 acres of this total were hand pulled and chemically sprayed, leaving a balance of 135.6 acres unfinished. The uncompleted acreage, together with re-eradication over the 207.4 acres sprayed in 1928, was to constitute the 1929 program and result in the elimination of the original stand of Ribes within a one-mile protection zone.

Observations made prior to starting the 1929 field season revealed almost a complete kill of R. petiolare, but the action of the $NaClO_3$ solution on R. inerme proved to be the reverse. Since R. inerme constituted 65 per cent of the Ribes population all efforts were concentrated on the removal of this species. On July 1st a crew of six men commenced hand pulling on Savenac Creek. The general plan was to first remove all Ribes from the areas sprayed the previous year. As the work progressed it became strikingly apparent that six men could not pull all the Ribes and the only alternative was a method of more rapid destruction such as chemical spraying, fire or a combination of both. As fire offered a possible solution two men commenced spraying the heavy concentrations of R. inerme on the St. Regis River, while the main crew continued hand pulling on Savenac Creek. While the Ribes were being removed from one and three-eighths miles of stream type along the Savenac Creek approximately forty acres of heavily concentrated clumps of R. inerme had been sprayed on the St. Regis and were ready to be fired. No thought was entertained of doing a thorough job of spraying. The sole object was to apply sufficient spray to create a good burn. Concentrated $NaClO_3$ was used.

Six men each devoted one day's time to setting fires and keeping them under control. Following the fire the entire crew was available for a systematic re-eradication of that portion of the St. Regis drainage worked in 1928. Had hand pulling alone been resorted to it is estimated that the end of the season would have found us occupied in removing Ribes from the St. Regis drainage.

RIBES ERADICATION, SAVENAC NURSERY, HAUGAN, MONTANA

By
C. M. Johnson,
Assistant Pathologist.

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INTRODUCTION

To protect the Savenac Nursery from blister rust required the removal of Ribes from 612.4 acres of stream type. During the 1929 season 476.9 acres of this total were hand pulled or chemically sprayed, leaving a balance of 135.5 acres unfinished. This uncompleted acreage, together with re-eradication over the 307.4 acres sprayed in 1929, was to constitute the 1930 program and result in the elimination of the original stand of Ribes within a one-mile protection zone.

Observations made prior to starting the 1930 field season revealed almost a complete kill of R. petiolare, but the action of the $NaClO_3$ solution on R. inerme proved to be the reverse. Since R. inerme constituted 80 per cent of the Ribes population all efforts were concentrated on the removal of this species. Early July a crew of six men commenced hand pulling on Savenac Creek. The general plan was to first remove all Ribes from the areas sprayed the previous year. As the work progressed it became evident that six men could not pull all the Ribes and the only alternative was a method of more rapid destruction such as chemical spraying, fire or a combination of both. As fire offered a possible solution two men commenced spraying the heavy concentration of R. inerme on the St. Regis River, while the main crew continued hand pulling on Savenac Creek. While the Ribes were being removed from the 1.6 miles of stream type along the Savenac Creek approximately thirty acres of heavily concentrated clumps of R. inerme had been sprayed on the St. Regis and were ready to be fired. No thought was entertained of doing a thorough job of spraying. The sole object was to apply sufficient spray to create a good burn. Concentrated $NaClO_3$ was used.

Six men each devoted one day's time to setting fires and keeping them under control. Following the fire the entire crew was available for a systematic re-eradication of that portion of the St. Regis drainage worked in 1929. Had hand pulling alone been resorted to it is estimated that the end of the season would have found us occupied in removing Ribes from the St. Regis drainage.

TABLE NO. 1.

COST ANALYSIS, STREAM TYPE ERADICATION, SAVENAC NURSERY, 1928.

Method of Eradication	Total Acreage Eradicated	Time: Foreman-Days	Time: Asst. Foreman-Days	Time: Laborer-Days	Total Cost	Cost Per Acre
Hand eradication	269.4	57.55	117 1/4	419 7/8	$3,640.46	$13.513
Chemical eradication	207.4	115.10	57 3/4	609 3/4	6,031.77	29.082
Combined hand and chemical	476.8	172.65	175	1,029 5/8	9,672.23	20.285

TABLE NO. 2.

COST ANALYSIS, STREAM TYPE ERADICATION, SAVENAC NURSERY, 1929.

Method of Eradication	Total Acreage Eradicated	Foreman-Days	Laborer-Days	Total Cost	Cost Per Acre
Hand pulling aided with chemicals and burning	244.4	62	398.5	$3,342.29	$13.675

The figure $13.513 in Table No. 1 represents the cost of hand eradicating on small tributary streams with Ribes density averaging light to medium.

The figure $29.082 indicates the cost of chemical eradication on major drainages in medium and heavy Ribes density.

The amount of $13.675 represents the cost per acre of eliminating medium to heavy concentrations of Ribes on major drainages by hand eradication following spraying and burning.

In 1928 four sample plots, each 1/3 acre in size and representing medium to heavy concentrations of R. petiolare and R. inerme, were laid out on Savenac Creek, Big Creek and St. Regis River. The average time figured per acre was 13 days. Figuring a cost of $5.00 per day brings the cost to $65.00 per acre.

The big reduction in cost, which amounted to $13.675 per acre in 1929, is attributed entirely to burning.

TABLE NO. 3.

TIME ANALYSIS, STREAM TYPE ERADICATION, SAVENAC NURSERY, 1929.

Drainage	Acreage Hand-Pulled	Acreage Sprayed	Total Acreage	Number Man-Days each Drainage	Number Man-Days Per Acre Eradicated
Savenac Creek	93.3	0.5	93.8	117.5	1.25
St. Regis River	61.0	61.6	122.6	148.0	1.20
Big Creek	26.0		26.0	132.5	5.09
Dry Creek	2.0		2.0	.5	.25
Totals	182.3	62.1	244.4	398.5	1.63

The 1.63 man-days in the preceding table represents the time element involved in eradicating the Ribes from one acre of stream type.

The original stand of Ribes along the St. Regis River consisted of 99 per cent R. inerme and R. lacustre and 1 per cent R. petiolare. On Savenac Creek and Big Creek 65 per cent were R. inerme and R. lacustre and 35 per cent R. petiolare. The R. petiolare was disposed of on the last-named drainage in 1928 leaving only 65 per cent of the total Ribes population to be eradicated in 1929.

Many thousands of bushes were consumed by flames which could not have otherwise been destroyed under methods now in general use.

Operations for the season were concluded on Big Creek. A fan-shaped area at the mouth of Big Creek, and upon which the _R. petiolare_ had been killed the previous year, was re-eradicated to eliminate the _R. inerme_. On Big Creek the _R. inerme_ are found to occur in dense masses, not extensively, but sufficiently so to make hand eradication appear almost impractical.

The fire hazard was great and a matter to be considered. The district ranger was consulted as to the most efficient and practical method of clearing the area. After careful consideration fire was recommended. Permission was obtained from the District Office at Missoula to burn. Dry snags were felled, brush and logs piled, 1,500 feet of fire hose assembled, and a pump installed. The brush which generally accompanies Ribes was nearly all dead as a result of the previous year's spraying. A very severe burn resulted. In spots where heavy concentrations of Ribes occurred in the midst of heavy windfall the fires burned several days. With only slight preparation the entire area sprayed by the power sprayer the previous year was cleared of Ribes, windfall and brush.

RESULTS FROM BURNING

1. The original stand of Ribes, together with brush and debris, was economically removed.

2. Large quantities of seed lying near the earth surface and beneath the duff were destroyed.

3. The way was paved for more severe root competition. Grasses can and will be made to replace the Ribes and brush.

EDUCATIONAL WORK, MONTANA - 1929

By
C. H. Johnson,
Assistant Pathologist.

The educational work this year consisted principally of interviews with heads of protective associations, lumber companies and state organizations with the object of familiarizing them with the true blister-rust situation in the state and adjacent territory.

The names of those interviewed are as follows: T. C. Spaulding, Dean, School of Forestry, University of Montana; Rutledge Parker, State Forester; A. E. Boorman, Secretary, Northern Montana Forestry Association and Roscoe Haines, Secretary, Blackfoot Protective Association also Forester and Land Agent for the Anaconda Copper Mining Company at Bonner, Montana.

RESULTS FROM INTERVIEWS

Rutledge Parker, State Forester for Montana, has pledged a sum of $250.00 and the equivalent in labor to start control work on state lands. The state has no appropriation for blister-rust work and the amount made available not only signifies a growing spirit in favor of blister-rust control but also gives encouragement for a gradually enlarged program.

The white-pine holdings of private owners are small and scattered in the state. The Anaconda Copper Mining Company owns approximately ten sections of white pine in northwestern Montana which were reconnaissanced in 1928. The timber is considered more or less isolated at present but Mr. Haines, Forester for that company, remarked that they would not stand by and look on when a program was started in that region.

In March a talk on blister rust was given before the University of Montana Forestry Club. This talk was supplemented with lantern slides showing every phase of our work in the West. Blister-rust material showing the various stages of the rust on pine and Ribes was distributed among park rangers in Glacier National Park.

EDUCATIONAL WORK, MONTANA - [illegible]

[illegible] Johnson,

[illegible]

The educational work this year consisted principally of interviews with heads of protective associations, [illegible] and state organizations with the object of familiarizing them with the true blister-rust situation in [illegible].

The names of those interviewed are as follows: [illegible] Spaulding, Dean, School of Forestry, University of Montana; Rutledge Parker, State Forester; [illegible], Secretary, [illegible] Montana Forestry Association and [illegible], Secretary, [illegible] Protective Association also forester and [illegible] for the [illegible] Copper Mining Company at Bonner, Montana.

[illegible]

Rutledge Parker, State Forester for Montana, [illegible] sum of $[illegible].00 and the equivalent in labor to start control work on state lands. The state has no appropriation for blister-rust work and the amount made available not only [illegible] in favor of blister-rust control but also gives encouragement for a gradually enlarged program.

The white-pine holdings of [illegible] are small and scattered in the state. The [illegible] Copper [illegible] own approximately ten sections of white pine in [illegible] Montana which were [illegible] in 1928. [illegible] is [illegible] isolated at present but Mr. [illegible], [illegible] for that company, remarked that they would not stand [illegible] started in that region.

In March a talk on blister rust was given before the [illegible] of Montana Forestry Club. This talk was supplemented with lantern slides showing every phase of [illegible]. [illegible] material showing the various stages of [illegible] was distributed among [illegible].

RESULTS OF CHECKING ERADICATION AT SAVENAC NURSERY, HAUGAN, MONTANA

by

H. N. Putnam

Associate Pathologist

In 1929 at Savenac Nursery, there were approximately 6 million Pinus monticola and 1 million P. strobus plants. In the fall of 1929 approximately $1\frac{1}{2}$ million P. monticola and $\frac{1}{2}$ million P. strobus trees were shipped to various points in District 1. Infection on R. petiolare was found 9 miles air line northwest of the nursery. It would be very difficult in District 1 to find an area for a nursery in which a greater volume of Ribes growth occurs within a radius of one mile. Because of the great profusion of Ribes growth it is extremely necessary to adequately protect this nursery from blister rust by the entire removal of Ribes within infecting distances as soon as possible.

In 1928 first attempts were made at Ribes eradication for a distance of one mile in all directions from the nursery. In 1929 portions of the area were re-eradicated by a small crew.

Tabel No. 1 shows the results of checking.

TABLE NO. 1

RESULTS OF CHECKING ERADICATION WORK AT SAVENAC NURSERY, HAUGAN, MONTANA, 1929

Year Eradicated	Stream Checked	Number Plots	Number Mil-acres	Ribes Feet Live Stem Left Per Acre R. petiolare	R. inerme	R. lacustre	Total
1928	Dry Creek	53	1,156	409	4,023	63	4,495
1928	Timber Creek	5	234	0	32	0	32
1928	Total	58	1,390	340	3,351	53	3,744
1928 & 1929	St. Regis River	31	4,252	6	1,246	8	1,260
1928 & 1929	Savenac Creek	26	2,208	100	302	14	416
1928 & 1929	Big Creek	4	696	3	112	0	115
1928 & 1929	Total	61	7,156	34	845	9	888
Grand Total		119	8,546	84	1,252	16	1,352

Since Dry and Timber creeks were not re-eradicated in 1929, it follows that the figure 3,744 represents the average feet of live stem per acre on these creeks now, and that the figure 1,352 represents the average feet of live stem per acre left at the present time over the entire area eradicated at Savenac Nursery.

It will be observed that R. inerme represents the most difficult eradication problem constituting nearly 93% of the Ribes live stem left.

A high per cent of the Ribes growth found in 1929 on Dry Creek which was eradicated in 1928 consisted of sprouts from bushes under water when sprayed in 1928, and seedlings.

Using Dry and Timber creeks as representative of conditions after the 1928 eradication, it is apparent that the 1929 work brought about a material reduction in feet of live stem per acre. But the fact remains that in no sense can Savenac Nursery be considered as protected from blister rust. To protect it adequately requires as near a 100% eradication as is humanly possible, and a yearly going over to keep it in a sanitary condition.

Yearly scouting for blister rust should be carried on. In 1930 the enormous numbers of cankers of 1927 origin will begin to produce aecia, and we can expect a heavy and widespread distribution of the rust on Ribes. Weather records at Savenac Nursery during the fire season of 1929 show a relative humidity per cent higher than the normal for the region. This may be due to the large amount of irrigation carried on at the nursery. Since this is so and since apparently a high relative humidity offers favorable conditions for rust development it is evident that the danger from blister rust is greater at the nursery than in the surrounding region. Ribes conditions are still so highly favorable for rust development at Haugan that we can expect next year to find rust on Ribes within the immediate vicinity of the nursery. To prevent the pines in the nursery from becoming infected from such sources it is highly important that in 1930 a large scale eradication job be undertaken as early as possible in order to destroy Ribes growth before the time of telial development.

PRE-ERADICATION ON GLACIER NATIONAL PARK, MONTANA

By
C. C. Strong,
Associate Forester.

In accordance with the request made by the National Park Service officials a preliminary examination of areas on Glacier National Park where western white pine was known to exist was made by C. H. Johnson and myself during the period June 10 to 14, 1929. As a result of this survey the following report is submitted:

A. Purpose.

1. To determine the feasibility and probable cost of protecting white pine areas on the Park against blister rust.

2. To secure such information regarding the conditions affecting Ribes eradication as would be necessary for planning the work should it be attempted.

B. Areas Examined.

All areas on which white pine was known to exist in sufficient quantities were surveyed in a preliminary manner. The largest area surveyed was that extending roughly from Park Headquarters near Belton northward to Lake McDonald with a narrow belt extending along the west side of the lake and up Fish Creek about two miles except where broken by the 1926 burn. This area also extends southwest along the Middle Fork of the Flathead River with narrow belts of white pine extending about two miles up two tributaries, one of which flows into the Middle Fork in section 34, township 32 north, range 19 west, Montana Meridian and the other flowing into the North Fork of the Flathead about 30 chains west of its junction with the Middle Fork. This latter portion of the area is low in quality so far as white pine is concerned, a large part of which forms an understory for larch and lodgepole pine and the balance mature trees forming less than 10 per cent volume of a stand, principally cedar, along streams and flat areas adjacent to streams.

The only other area examined where white pine existed in sufficient amounts to warrant consideration was that centering at the junction of Mineral and McDonald Creeks in township 35 north, range 17 west, Montana Meridian. This area, comprising roughly 2,000 acres, supports the best stand of white pine found on the park. It is all a part of a mature timber stand and (perhaps 10 years ago) probably comprised 40 per cent of the timber present. However, about one-half of the white pine trees which were alive 10 years ago have been killed by Dendroctonus

PRE-ERADICATION [illegible]

by

[illegible],

Associate [illegible].

In accordance with [illegible] request made by the National Park Service officials a preliminary examination of [illegible] National Park where western white pine was known to exist was made by [illegible] Johnson and myself during the period June 10 to 14, [illegible]. As a result of this survey the following report is [illegible]:

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monticolae, or white pine bark beetle, during the intervening years. The bark beetles are still at work as evidenced by the hundreds of trees scattered over the whole area which are in a dying condition.

A certain amount of scouting was done for the purpose of determining whether or not there were other important white pine areas but none were found. According to the best information secured the two main bodies described represent about all of the white pine area on which protection would be highly desirable to the Park Service.

C. Conditions Affecting Ribes Eradication.

On the area centering about Park Headquarters Ribes were found to exist in very definite locations. There is a narrow belt along the bottom of the north slope of the Belton Hills extending the entire distance to Lake McDonald which has four species of Ribes; namely, Ribes inerme, R. setosa, R. lacustre and R. viscosissimum. On the balance of the area R. lacustre only was found and then only in a narrow belt bordering the streams and swampy spots. Thus the main body of the area would need only to be scouted for wet and swampy spots where Ribes might exist leaving only the Ribes populated areas described above to be worked by regular eradication crews.

That portion of the area lying well up on Fern and Fish Creeks is being damaged quite heavily by the bark beetle.

The Mineral Creek area, although much rougher in topography and far less accessible, would not be difficult to protect due to the presence of only one Ribes species, R. lacustre. However, it is present in far greater numbers than on the Headquarters area but is almost entirely confined to the same sites, namely, along streams and on rocky outcrops, swampy areas and seepages. The same method of working would be followed.

D. Cost of First Eradication of Ribes.

The nearest estimate regarding cost of original Ribes eradication on the two areas, based on the brief survey made is that it would probably not exceed $3,000.00. Roughly the cost would be about equally divided between the areas.

E. Recommendations.

On the basis of the information secured it would hardly seem advisable to attempt Ribes eradication for controlling possible future damage by the rust unless measures are taken within the next year to stop

monticolae, or white pine bark beetle, during the last [illegible]. The bark beetles are still at work as evidenced by the numbers of [illegible] scattered over the whole area which are in a dying condition.

A certain amount of scouting was done for the purpose of determining whether or not there were other important white pine areas. None were found. According to the best information secured the two main bodies described represent about all of the white pine [illegible] protection would be highly desirable to the [illegible].

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the present heavy losses due to the bark beetle. Protection against both the beetle and the rust is urgently needed if the white pine is to remain intact. The two operations might be simultaneously done more economically than as two separate operations at different times.

Of the two, the Mineral Creek area probably stands much less chance of being attacked by the rust in the near future. In fact the presence of only R. lacustre, the great distance from other white pine areas and the fact that it is almost completely hemmed in by high mountains might result in the area being safe from infection for many years. On the other hand the history of the rust development in the West makes it impossible to forecast when and where it will strike next with the result that no areas appear to be safe.

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SCOUTING FOR BLISTER RUST, NORTHWESTERN MONTANA - 1929

By
C. H. Johnson,
Assistant Pathologist.

Intensive scouting by scouts under the supervision of H. N. Putnam was conducted along the upper St. Regis River and tributaries from the vicinity of Savenac Nursery and westward to the Montana-Idaho boundary. One light infestation on *R. petiolare* was found approximately nine miles west of the Savenac Nursery.

TABLE NO. 1.

SCOUTING FOR BLISTER RUST, VICINITY SAVENAC NURSERY, AUGUST AND SEPTEMBER, 1929.

Locality	Number Inspected R. pet.	R. iner.	R. vis.	R. lac.	Total	No. Infected	Pines Exam.	Pines Infec.
Big Creek and tributaries	1,970	810		50	2,830	0	320	0
Silver Creek and Big Sandy Creek	5,840	580	720	370	7,510	0		
Dominion Creek	1,350	20		20	1,390	0	805	0
Rainy Creek	1,000	20		10	1,030	0	500	0
Dismore Creek	1,000	50			1,050	0	10	0
Honaker Creek *	350	40			390	0	25	0
Brimstone Creek*	700				700	0	15	0
Randolph Creek	4,450	200		40	4,690	1	170	0
Savenac Creek and tributaries	3,450	50		240	3,740	0	350	0
Twin Creek and tributaries	956	10		70	1,036	0	85	0
Dry Creek	50	50		15	115	0	0	0
Timber Creek		5			5	0	0	0
Deer Creek	1,240	25	30	350	1,645	0	685	0
Packer Creek and tributaries	850	20		10	880	0	11	0
St. Regis River	6,220	900		17	7,137	0	131	0
Total	29,426	2,780	750	1,192	34,148	1	3,107	0

*On Honaker and Brimstone Creeks 850 *R. triste* inspected.

The scouting conducted by the writer on the Kootenai, Cabinet, Blackfoot, Flathead and Missoula National Forests was more extensive.

TABLE NO. 2.

SCOUTING FOR BLISTER RUST NORTHWESTERN MONTANA, SEPTEMBER, OCTOBER AND NOVEMBER, 1929.

Locality	Number Inspected				
	R. petiolare	R. inerme	R. lacustre	R. visco.	Total
Blackfoot River and tributaries	300		180		480
St. Regis River and tributaries	1,100	720			1,820
Bull River and tributaries		650			650
Kootenai River and tributaries	15	1,460			1,475
Yaak River and tributaries		1,320		80	1,400
Fisher River		650			650
Stillwater Lakes	40	860			900
Flathead River and tributaries	35	938	63		1,036
Swan River and tributaries	480		60		540
Bitter Root River and tributaries	540	600			1,140
Missoula River and tributaries	420	700			1,120
Totals	2,930	7,898	303	80	11,211

BLISTER-RUST-CONTROL WORK IN IDAHO
1929

Blister-rust-control work in Idaho was carried on, as in the past, as a cooperative project between the Idaho State Department of Agriculture, University of Idaho, Idaho State Board of Forestry, Potlatch Timber Protective Association, Clearwater Timber Protective Association, Coeur d'Alene Timber Protective Association, Pend Oreille Timber Protective Association, Priest Lake Timber Protective Association and the Bureau of Plant Industry. The basic memorandum of understanding upon which this work was organized was made effective July 1, 1927 and can be found in the report for that calendar year. The following is the amendment to this memorandum to cover the work as organized for the Federal fiscal year 1930, beginning July 1, 1929:

AMENDMENT TO
MEMORANDUM OF UNDERSTANDING
Effective July 1, 1927

Between
THE UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY
and the
IDAHO STATE DEPARTMENT OF AGRICULTURE - - - UNIVERSITY OF IDAHO - - - IDAHO STATE BOARD OF FORESTRY - - - POTLATCH TIMBER PROTECTIVE ASSOCIATION - - - CLEARWATER TIMBER PROTECTIVE ASSOCIATION - - - COEUR D'ALENE TIMBER PROTECTIVE ASSOCIATION - - - PEND OREILLE TIMBER PROTECTIVE ASSOCIATION - - - and the PRIEST LAKE TIMBER PROTECTIVE ASSOCIATION

Cooperative Work in Controlling White Pine Blister Rust in IDAHO

* * *

Paragraph J-6, of the Memorandum of Understanding described above, contains the following:

"For the Fiscal Year 1928, the Bureau of Plant Industry shall contribute in value approximately $78,000 to the support of this cooperative work, the Idaho State Department of Agriculture shall contribute in value approximately $1,100, the University of Idaho approximately $4,000, the Potlatch Timber Protective Association approximately $3,800, the Clearwater Timber Protective Association approximately $3,800, the Coeur d'Alene Timber Protective Association approximately $3,800, the Pend Oreille Timber Protective Association approximately $3,800, and the Priest Lake Timber Protective Association approximately $4,340; thereafter the amount to be

contributed by each shall be determined and agreed upon by supplemental correspondence."

In accordance with the foregoing provisions, it is mutually agreed that for the fiscal year ending June 30, 1930, there will be contributed in value by the Idaho State Department of Agriculture approximately $2,000, by the University of Idaho approximately $4,000, by the Potlatch Timber Protective Association approximately $10,000, by the Clearwater Timber Protective Association approximately $10,000, by the Coeur d'Alene Timber Protective Association approximately $ 2,300, by the Pend Oreille Timber Protective Association approximately $ 2,300, by the Priest Lake Timber Protective Association approximately $ 2,300, and by the United States Department of Agriculture, Bureau of Plant Industry, through its Office of Blister Rust Control, approximately $83,000 in connection with cooperative blister rust control work in Idaho.

Date:	Signature:
10/1/29	(s) John S. Welch Commissioner, Idaho State Department of Agriculture
10/7/29	(s) F. G. Miller University of Idaho
10/31/29	(s) Ben E. Bush State Forester, Idaho State Board of Forestry
11/12/29	(s) A. W. Laird President, Potlatch Timber Protective Association
11/20/29	(s) Theo Fohl Secy-Treas. Clearwater Timber Protective Association
12/16/29	(s) C. O. Graue Secy., Coeur d'Alene Timber Protective Association
12/3/29	(s) T. L. Greer Secy., Pend Oreille Timber Protective Association
12/24/29	(s) J. S. Barron Secy., Priest Lake Timber Protective Association
1/6/30	(s) Wm. A. Taylor Chief, Bureau of Plant Industry

RIBES ECOLOGY IN THE INLAND EMPIRE, 1929

by
W. A. Rockie
Assistant Pathologist

I. Definition

This project conducts research and experimental investigation into the relations of Ribes to their environment. It investigates why, how, when and where Ribes grow.

Its application to the control program is two-fold, first to furnish facts regarding Ribes which will aid in eradication, and second, to investigate the possibility of evolving a forest management plan which will prevent or retard the inception and growth of new Ribes stands.

II. Methods

The methods and working plans have necessarily been evolved for each individual line of study. These are described under the various lines of work.

Several of these studies were made possible through the cooperation of the University of Idaho. The advice and suggestions of members of the faculty, together with the use of laboratory space and equipment, were very important factors contributing to the success of these research studies.

Investigations of the following studies are in progress:

A. Controlled Plot Study of Ribes.
B. Light-Moisture-Duff Study.
C. Life Habits of Ribes.
D. Ribes Seed Germination Tests.
E. Leaf-Area Live-Stem Studies.
F. Temperature-Moisture Investigations.
G. Soil Acidity Investigations.

III. Results

The results are listed under the reports of the respective individual studies, which are described in the succeeding pages.

W. 359 General view of a set of controlled plots during their preparation at Lakeview, Idaho. August 1927.

W. 852 Duplicate of W. 359 after slightly more than 2 years, showing the new vegetation which has come in on the area. Consists of Salix, Rubus, Pteridium, Ribes, Epilobium, Cirsium, Aster, Cornus, Linnaea, Coptis, Pachystima. The burned areas usually show only Ribes, Epilobium, Bull Thistle and Aster for several years following burning. November 1929.

These duplicate photographs show the vegetation changes during two growing seasons. Controlled Plot Study at Lakeview, Idaho.

W. 358 Shows heavy burn plot at time of preparation. Burning has just been completed. August 1927.

W. 853 Duplicate of W. 358 after slightly more than 2 years. Later picture shows scattered dead stalks of Aster and Bull Thistle. Very little other vegetation has come in on this heavy burn plot. November 1929.

Heavy burn plots have a different flora from the other types of plots. Flora chiefly plants having very light wind-blown seeds. Controlled Plot Study at Lakeview, Idaho.

A. CONTROLLED PLOT STUDY OF RIBES

I. Definition

Described on pages 27 and 28 of the 1928 Annual Report.

II. Methods

Described on page 28 of the 1928 Annual Report.

III. Results

The controlled plots initiated in 1927 are summarized as one group of studies, and those begun in 1928 as another group. These summaries present the major results from these studies.

Graph No. 1 (1927 Controlled Plots) shows the effects of different disturbances of the duff mantle on the germination and survival of volunteer Ribes. The pertinent points of this graph, which have not been stated in preceding annual reports, are as follows:

1. Although the check plots are almost all entirely without Ribes, the conditions controlling a few of these check plots have induced the inception of new Ribes in such numbers that the average number of Ribes for all check plots is made rather high. These few check plots have many Ribes from at least two known causes, first, due to one of our men carelessly crawling over some low-roofed plots and gouging into the duff with calked shoes and, second, due to gravity causing the duff to slip and break open on the sidehill plots. The result in both instances was to cause a sufficiently higher temperature at the base of the duff to cause Ribes to germinate.

2. The plots with top duff removed and with all duff removed have given results very much alike, with a living population at the end of 1929 of from 15,000 to 20,000 Ribes per acre.

3. The different degrees of burning are consistent with the resultant Ribes population, the lighter burns destroying a minimum of the stored seed. The heavy burns destroy almost all of the stored seed.

4. The burned plots show that germination is almost complete the first year, while the unburned plots have a heavy additional germination the second year.

Graph No. 1

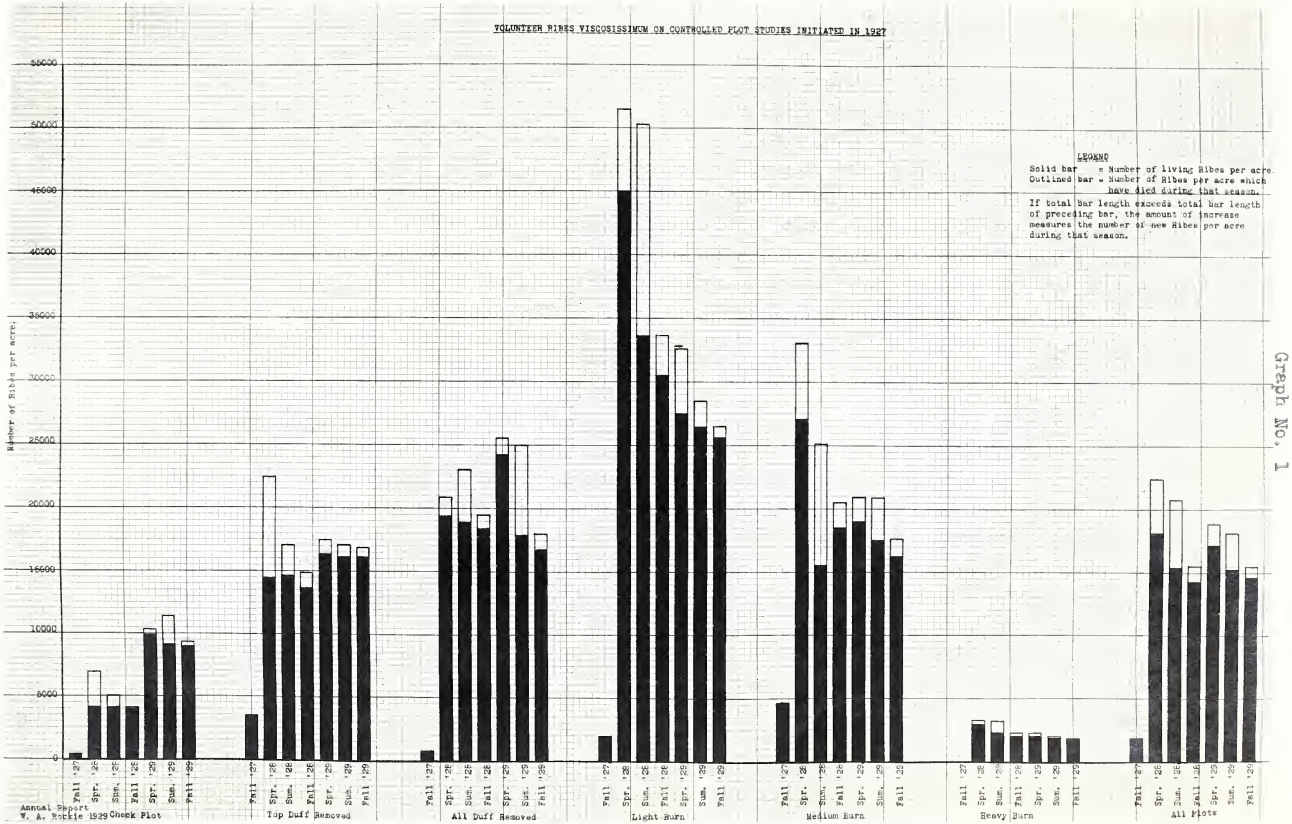

VOLUNTEER RIBES VISCOSISSIMUM ON CONTROLLED PLOT STUDIES INITIATED IN 1927
LEGEND
Solid bar = Number of living Ribes per acre.
Outlined bar = Number of Ribes per acre which have died during that season.
If total bar length exceeds total bar length of preceding bar, the amount of increase measures the number of new Ribes per acre during that season.
Number of Ribes per acre.
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Fall '27
Spr. '28
Sum. '28
Fall '28
Spr. '29
Sum. '29
Fall '29
Check Plot
Top Duff Removed
All Duff Removed
Light Burn
Medium Burn
Heavy Burn
All Plots
Annual Report
W. A. Rockie 1929

TABLE NO. 1

SEASONAL GERMINATION OF VOLUNTEER RIBES
IN 1927 CONTROLLED PLOTS

		1928			1929			
	Fall 1927	Spring	Summer	Fall	Spring	Summer	Fall	Total
No. Ribes Per Acre	400.0	4,100.0	540.0	30.0	900.0	200.0	60.0	6,230.0
Per Cent of Total		65.8	8.7	.5	14.4	3.2	1.0	
Germination	6.4	75.0			18.6			100.0

TABLE NO. 2

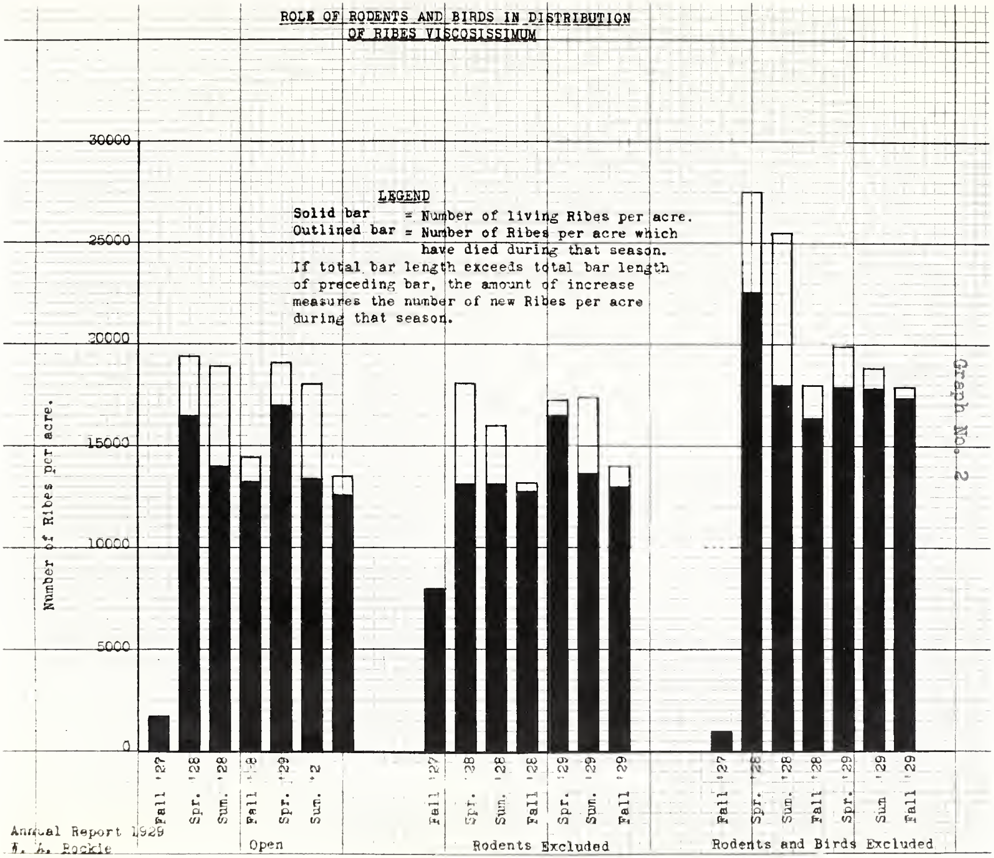
SEASONAL CASUALTIES OF VOLUNTEER RIBES
IN 1927 CONTROLLED PLOTS

		1928			1929			
	Fall 1927	Spring	Summer	Fall	Spring	Summer	Fall	Total
No. Ribes Per Acre	-	850.0	1,070.0	250.0	330.0	590.0	160.0	3,250.0
Per Cent of Total		26.2	32.9	7.7	10.1	18.1	5.0	
Casualties	-	66.8			33.2			100.0

5. The casualties of Ribes plants in the three initial seasons of growth, represent from 50 to 60 per cent of the total germination on these plots. The casualties are usually more than the average on areas of heavy Ribes concentration, and less than average on areas where Ribes are scattered.

6. Averaging all of the plots together, an average which tends to resemble the varied conditions which succeed a logging operation, a study of the Ribes is summarized in Tables No. 1 and 2.

Table No. 1 shows that germination occurred chiefly during the first spring season, but that it does occur at all times during each growing season. It also shows that germination within any given year takes place naturally in the spring, with a much smaller number of plants appearing in the summer and fall.


ROLE OF RODENTS AND BIRDS IN DISTRIBUTION OF RIBES VISCOSISSIMUM
Graph No. 2
LEGEND
Solid bar = Number of living Ribes per acre.
Outlined bar = Number of Ribes per acre which have died during that season.
If total bar length exceeds total bar length of preceding bar, the amount of increase measures the number of new Ribes per acre during that season.
Number of Ribes per acre.
30000
25000
20000
15000
10000
5000
0
Fall '27
Spr. '28
Sum. '28
Fall '28
Spr. '29
Sum. '2
Open
Fall '27
Spr. '28
Sum. '28
Fall '28
Spr. '29
Sum. '29
Fall '29
Rodents Excluded
Fall '27
Spr. '28
Sum. '28
Fall '28
Spr. '29
Sum. '29
Fall '29
Rodents and Birds Excluded
Annual Report 1929

7. The casualties of these newly incepted Ribes are shown in Table No. 2.

It shows that two-thirds of the casualties occurred during the first growing season. This resulted in spite of the fact that 1929, the second growing season, was considered one of the least favorable recent years for plant growth and survival.

8. It is shown by Tables No. 1 and 2 that out of an average of 6,230 volunteer Ribes per acre, 3,250 or 52.2% had died at the end of the 1929 field season.

Graph No. 2 shows a comparison of the Ribes germination in the three differently protected blocks. Block I is not protected from birds and rodents, Block II is fenced against rodents and Block III is fenced and roofed so that neither birds nor rodents have access to the block. These blocks have been thus protected during the fruiting periods of Ribes since the summer of 1927, when they were put under control.

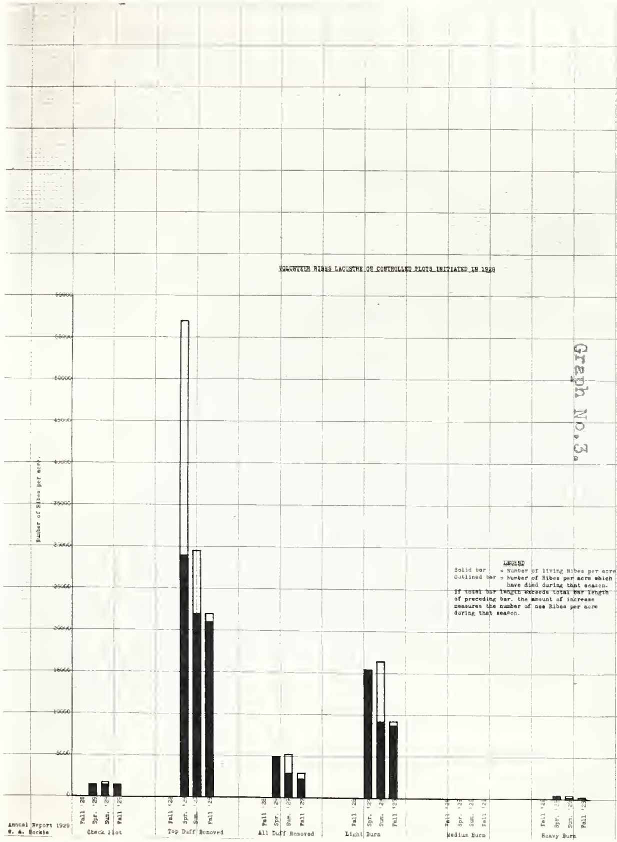
The presence of fairly equal numbers of Ribes in the three differently protected areas, very definitely indicates that birds and rodents are a minor factor in the geographical spread of Ribes. The fact that Block III, from which both rodents and birds have been excluded, has more Ribes than either of the other blocks, may be explained in three ways.

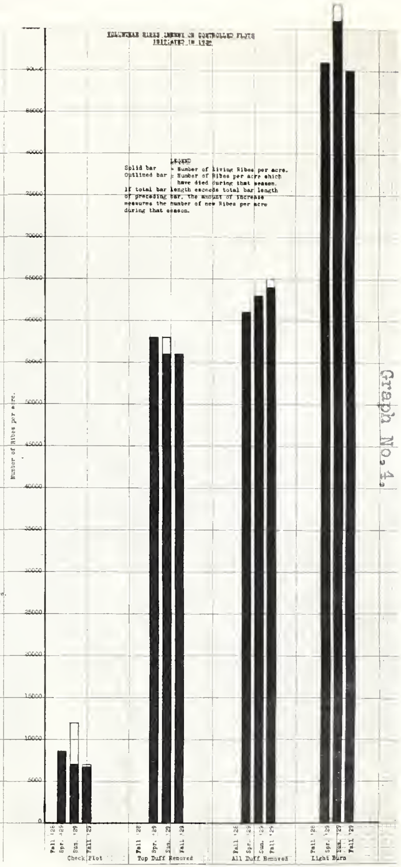
A few local abnormally heavy concentrations of Ribes within units of this block would be sufficient to bring the average population above another average in an otherwise similar area. A glance at the maps showing the very local bunching of these Ribes is evidence that this may be the true explanation.

The Ribes averages of the covered blocks include several partial sets of controlled plots having very populous Ribes covers which are not offset by similar plots in the other two blocks. This may explain the difference.

Still another plausible explanation is that the changed temperature and moisture conditions within the covered blocks, may result in better germination conditions than those provided by nature.

Any or all of these three causes may explain the heavier Ribes population in the covered block.


Graph No. 3.
VOLUNTEER RIBES LACUSTRE ON CONTROLLED PLOTS INITIATED IN 1928
Number of Ribes per acre.
LEGEND
Solid bar = Number of living Ribes per acre.
Outlined bar = Number of Ribes per acre which have died during that season.
If total bar length exceeds total bar length of preceding bar, the amount of increase measures the number of new Ribes per acre during that season.
Check Plot
Top Duff Removed
All Duff Removed
Light Burn
Medium Burn
Heavy Burn
Annual Report 1929


Graph No. 4.
Number of Ribes per acre.
LEGEND
Solid bar = Number of living Ribes per acre.
Outlined bar = Number of Ribes per acre which have died during that season.
If total bar length exceeds total bar length of preceding bar, the amount of increase measures the number of new Ribes per acre during that season.
Check Plot
Top Duff Removed
All Duff Removed
Light Burn

Graph No. 3 shows the results of two controlled plot studies started in 1928. These areas resulted in the inception of seedlings of R. lacustre only.

The actual number of plots is so small that the very local occurrence of Ribes seeds in a given area is the striking feature. The results appear identical to the results from selected areas on which R. viscosissimum has appeared. These local irregularities are eliminated only by the averaging of the data of a large number of plots. One difference of these R. lacustre controlled plots from those of R. viscosissimum is that a dense canopy of mature timber still covers one of the two areas.

TABLE NO. 3

FIELD GERMINATION OF PLANTED RIBES FRUITS

Type of Ground Disturbance	No. of Fruits Planted	Results: No. That Germiniated: In 1928	Repeated 1929	New 1929	Total No. Fruits	Results: Per Cent That Germinated: In 1928	Repeated 1929	New 1929	Total No. Fruits
Unburned Plots									
a. Undisturbed Check Plot	208	2	-	1	3	.96	-	.48	1.44
b. Top Duff Removed	188	15	3	1	16	7.98	1.60	.53	8.51
c. All Duff Removed	116	14	-	1	15	12.07	-	.86	12.93
Total & Ave. on Unburned Plots	512	31	3	3	34	6.05	.59	.59	6.64
Burned Plots									
a. Light Burn	188	96	-	7	103	51.06	-	3.72	54.78
b. Medium Burn	48	33	3	1	34	68.75	6.67	2.08	70.83
c. Heavy Burn	168	80	1	6	86	47.62	.60	3.57	51.19
Total & Ave. on Burned Plots	404	209	4	14	223	51.73	.99	3.47	55.20
Grand Total & Ave.	916	240	7	17	257	26.20	.76	1.86	28.06

TABLE NO. 4

GERMINATION FROM FIELD PLANTINGS OF RIBES SEEDS

Type of Ground Disturbance	Number of Fruits Planted	Number of Ribes Seedlings: In 1928	In 1929: From Fruits Which Also Had Germinated 1928	In 1929: From Fruits Dormant in 1928
Unburned Plots				
a. Undisturbed Check Plot	208	31	-	1
b. Top Duff Removed	188	62	1	6
c. All Duff Removed	116	19	-	1
Total on Unburned Plots	512	112	1	8
Burned Plots				
a. Light Burn	188	1,213	35	45
b. Medium Burn	48	551	37	21
c. Heavy Burn	168	530	83	31
Total on Burned Plots	404	2,294	155	97
Grand Total	916	2,406	156	105

Graph No. 4 showing the results of a controlled plot study on a potential R. inerme site, is directly comparable to the R. viscosissimum controlled plot studies. The similarity of results indicates that R. inerme reacts identically with R. viscosissimum.

The planting studies in connection with the controlled plots are summarized in Table No. 3. The results of the second year of germination are corroborative of the previous year's findings. The second year's germination of the planted fruits shows five times as many fruits germinating on the burned as on the unburned plots. The first year showed more than eight times as much. This second year's record includes only those fruits which did not germinate during the first year. Several fruits showed germination in both 1928 and 1929, but these are shown in a separate column of the same table.

Table No. 4 shows the number of seedlings which developed on the various types of plots.

The 1928 seedlings totaled more than 20 times as many on the burned as on the unburned plots, while the 1929 seedlings totaled 28 times as many on the burned as on the unburned plots.

The results obtained from these planted fruits definitely prove that dormancy without losing viability is a characteristic of R. viscosissimum.

B. LIGHT-MOISTURE-DUFF STUDY

I. Definition

Described on page 195 of the 1927 Annual Report.

II. Methods

Described on pages 195, 196 and 197 of the 1927 Annual Report.

III. Results

The results of the triple disturbance are as follows:

a. The three-fold results are best shown in Graph No. 5.

This graph shows that these three changes are of unequal importance and effect.

The third year of the experiment adds some additional apparent facts to the results described on page 49 of the 1928 Annual Report.

These additional effects of (1), the removal of the timber canopy, can be stated as follows:

1. Very little change in Ribes population.
2. Permanent establishment of the new Ribes stand.

The added effects of (2), trenching to cut all roots which enter the area, appear to indicate exactly the same results as during the preceding year.

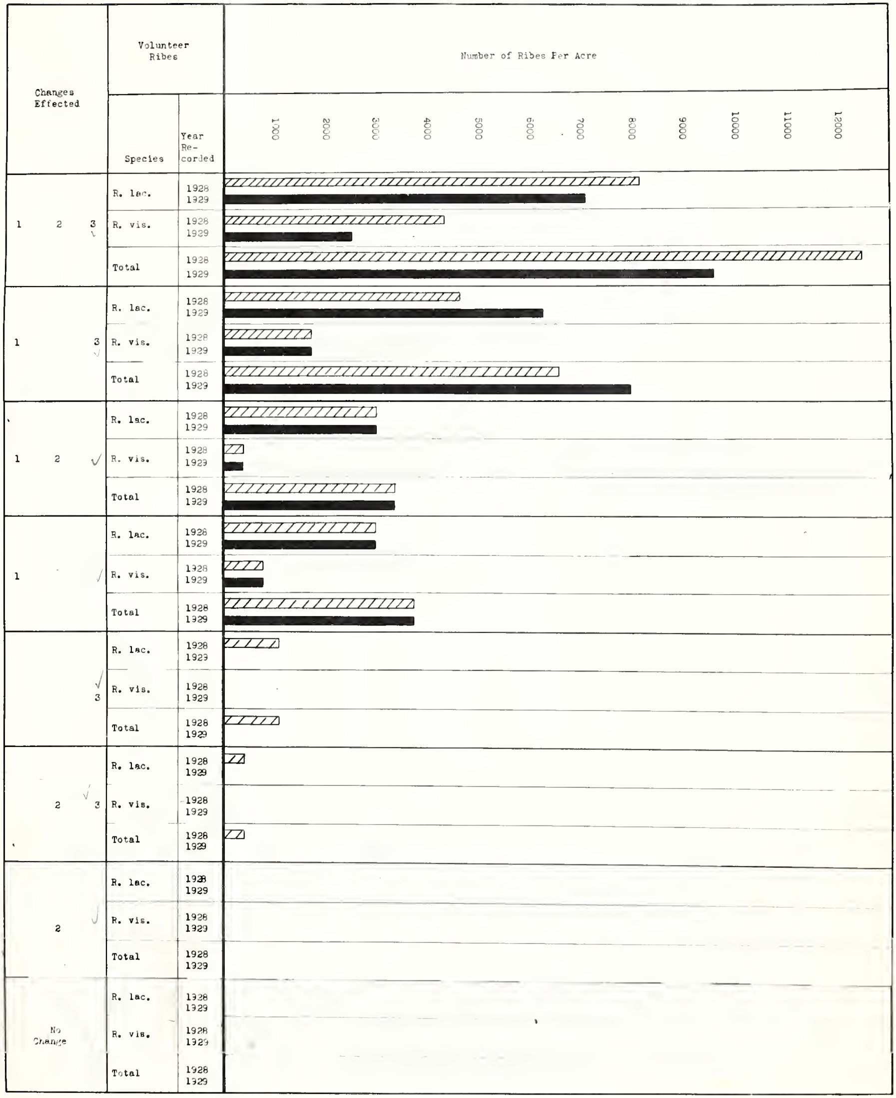
The additional effects of (3), loosening of duff, can be stated as follows:

1. Where timber was removed, establishment of new Ribes appears permanent.
2. Where timber was not removed, all Ribes seedlings died before the end of 1929.

In summary, it appears that the removal of the timber canopy is the only one of the three changes which brings about the permanent establishment of a new Ribes stand. The loosening of the duff causes the inception of a new stand of R. lacustre, but only of a temporary character, since it seldom survives the first growing season. The trenching of the plot appears to be without effect.

Graph No. 5

LIGHT-MOISTURE-DUFF STUDY



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1 Timber canopy removed.
2 Trenching 24" deep.
3 Duff disturbed.

TABLE NO. 5

ROOT COMPETITION, 1929

Name of Plot	No. of Milacres Trenched	No. of Milacres Un-trenched	No. of Ribes Trenched Germ-in-ated	No. of Ribes Trenched Sur-vived	No. of Ribes Un-trenched	Ribes Per Acre Trenched Germin-ated	Ribes Per Acre Trenched Sur-vived	Ribes Per Acre Un-trenched
Lakeview #1	1	1	-	-	-	-	-	-
Lakeview #2	1	1	212	154	-	212,000	154,000	-
Lakeview #3	1	1	12	6	-	12,000	6,000	-
Lakeview #4	1	1	20	17	-	20,000	17,000	-
Meadow Cr.#1	3	3	-	-	-	-	-	-
Meadow Cr.#2	3	3	-	-	-	-	-	-
Meadow Cr.#3	1	1	59	52	-	59,000	52,000	-
Meadow Cr.#4	1	1	4	3	-	4,000	3,000	-
Meadow Cr.#5	1	1	-	-	-	-	-	-
Meadow Cr.#6	1	1	-	-	-	-	-	-
Meadow Cr.#7	1	1	-	-	-	-	-	-
Meadow Cr.#8	1	1	-	-	-	-	-	-
Meadow Cr.#9	1	1	-	-	-	-	-	-
Meadow Cr.#10	1	1	-	-	-	-	-	-
Meadow Cr.#11	1	1	-	-	-	-	-	-
Meadow Cr.#12	1	1	-	-	-	-	-	-
Meadow Cr.#13	1	1	-	-	-	-	-	-
Totals & Averages	21	21	307	232	-	14,619	11,048	-

b. The results of the single disturbance experiments (root competition) are as follows:

The numerical results are shown in Table No. 5.

Although the second year of these trenched plots showed practically no Ribes germination inside the trenched area, the third year shows many Ribes occurring on 5 of the 21 milacre plots. This germination developed in sufficient quantity on these few plots to be striking. On the other hand, the absence of new plant growth in general, and of Ribes in particular, from the remaining 16 plots, is even more striking. This latter condition indicates that some marked disturbance has occurred on the 5 plots now having Ribes. This is entirely possible since they are not protected by a fence of any kind. Cattle and deer are commonly seen in the immediate vicinities.

Until more than 5 out of 21 plots show a response to the elimination of root competition, it appears that root competition should not be considered as a dominant factor. Additional annual examinations of these experimental plots are necessary before a conclusive statement is possible.

C. LIFE HABITS OF RIBES

I. Definition

Described on page 51 of the 1928 Annual Report.

II. Methods

Described on page 51 of the 1928 Annual Report.

III. Results

The 1928 fruits of *R. lacustre* and of *R. viscosissimum* were found still adhering by their leaf stems on all of the caged bushes which were still enclosed.

The clump of 212 Ribes seedlings, first described in the 1926 annual report, now numbers 19 Ribes plants.

General observations on the growth of Ribes on the controlled plots and other study areas now indicate that the average Ribes begins fruiting at a more advanced age than was previously thought. It is the exceptional bush which fruits in its third year. It is the exceptional stand which is fruiting commonly in its fifth year. In 1930, all of the Ribes on the experimental plots will be measured to determine the average size of these plants. Each Ribes bush is staked and its age is positively known, so this will yield definite information on Ribes up to 5 years of age.

With more individual observations, it has become increasingly evident that most of the fruits of the Ribes species of northern Idaho are removed from the parent bushes before reaching maturity. All observations point to their consumption by the smaller rodents, generally while in an unripe condition.

Fruits of all of the northern Idaho Ribes species were desired for the seed germination studies in the laboratory but scarcely any fruits could be found in a ripened condition. These same bushes were fruiting heavily two weeks previously.

Additional data were taken on the phenology of Ribes. These observations were particularly relative to the leafing out, the blooming and the fruiting of the several species.

D. RIBES SEED GERMINATION NEAR HARVARD, IDAHO

I. Definition and II. Methods

Described under C. on page 56 of the 1928 Annual Report.

III. Results

i. Since 100 seeds were planted under each set of conditions, the number of seedlings shown in Table No. 6 represents the actual percentage of germination.

TABLE NO. 6

RIBES SEED GERMINATION FROM PLANTED SEEDS, HARVARD, IDAHO

Age of Ribes Seed	2" Sawdust Mantle			Bare Mineral Soil			1/4" Charcoal Mantle			Average of All Soil Mantles			
	R. lac.	R. iner.	R. vis.	R. lac.	R. iner.	R. vis.	R. lac.	R. iner.	R. vis.	R. lac.	R. iner.	R. vis.	All Ribes
1927 Seed Crop	0	4.0	0	36.0	85.0	7.0	47.0	67.0	12.0	27.7	52.0	6.3	28.7
1928 Seed Crop	0	3.0	0	29.0	49.0	7.0	39.0	57.0	11.0	22.7	36.3	6.0	21.3
Both Seed	0	3.5	0	32.5	67.0	7.0	43.0	62.0	11.5	25.2	44.2	6.2	25.2
Crops		1.2			35.5			38.8			25.2		

The result is three-fold. The effect of the soil mantle is striking. The sawdust mantle, whose effect approximates that of a duff mantle, has 1.2%, while the other soil surfaces are very much alike, with 35.5% and 38.8% respectively for the bare soil and the charcoal surfaces. The differences appear to be resultant from temperature differences more than from any other factor.

The comparative germination by species is even more striking, R. inerme leading with 44.2%. R. lacustre has 25.2% and R. viscosissimum only 6.2%.

The comparative germination by age of seed shows no conclusive difference, the year-old seed yielding 28.7% and the new seed 21.3%. The true seed germination was probably higher than these figures, since the count includes only the plants which grew to sufficient size to permit positive identification as Ribes.

E. LEAF-AREA LIVE-STEM STUDIES

I. Definition

Described on page 212 of the 1927 Annual Report.

II. Methods

Described on page 212 of the 1927 Annual Report.

III. Results

Circular scales for the measurement of leaves of R. viscosissimum, R. lacustre and R. inerme have been made in preceding years.

Sufficient leaves of R. petiolare were gathered and pressed in 1929 to make a similar scale for the measurement of the leaves of that species. These measurements are now in progress and by the end of the present winter a leaf scale for each of the common species of northern Idaho should be available.

F. TEMPERATURE-MOISTURE INVESTIGATIONS

I. Definition

To isolate and to measure the effects of the various site factors upon the germination and growth of the four common species of Ribes in white-pine stands.

II. Methods

This is primarily a study of forest soil temperatures, as they pertain to the germination and growth of Ribes. The changes caused by different types of logging were particularly investigated.

The comparative per [illegible] by species [illegible], *R. inerme* leading with 44.3%. *R. lacustre* [illegible] *R. viscosissimum* only 6.2%.

The comparative germination by age of seed [illegible] difference, the year-old seed yielding [illegible] and the new seed [illegible]. The true seed germination was probably higher than these figures, since the count includes only the plants which grew to sufficient size to permit positive identification as Ribes.

D. [illegible]

I. Definition

Described on page [illegible] of the [illegible] Annual Report.

II. Methods

Described on page [illegible] of the 1927 Annual Report.

III. Results

Circular scales for the measurement of [illegible] of *R. viscosissimum*, *R. lacustre* and *R. inerme* have been made in [illegible].

Sufficient leaves of *R. petiolare* were gathered [illegible] in 1929 to make a similar scale for the measurement of the leaves of that species. These measurements are now in progress and by the end of the present winter a leaf scale for each of the common species of [illegible] Idaho should be available.

E. [illegible]

I. Definition

To isolate and to measure the effects of the various [illegible] factors upon the germination and growth of the four common species of Ribes in white-pine stands.

II. Methods

This is primarily a study of forest soil [illegible] as they pertain to the germination and growth of Ribes. The [illegible] of different types of logging were particularly investigated.

Thermocouples and galvanometer were the instruments used for measuring these temperatures.

The temperature measurements were taken at the point where duff and mineral soil meet. It had already been determined that most of the dormant Ribes seeds are located at that point in the soil section.

Records of preceding years indicated that certain general effects were the result of certain factors but these factors had not been sufficiently isolated for measurement.

III. Results

Dense virgin stands of white pine were selected near Harvard, Idaho and near Headquarters, Idaho. Both of these areas were recorded preceding and following clear-cut logging to secure an absolute measurement of the canopy's insulation at several points.

The temperature at the point of contact between duff and mineral soil was taken.

1. Before the logging was initiated.
2. After the timber canopy was removed.
3. After the duff was loosened from its naturally compact condition.
4. After the undisturbed duff was lightly burned.
5. After the top duff was removed.
6. After all the duff was removed.

Not all of the six conditions were necessarily recorded at each selected spot.

Graphs No. 6 to 8 show the results of these investigations. Graph No. 6, which shows the records at Harvard, Idaho, also includes a record made at the same spot two months later than the record made in July. This later record shows that seasonal effects upon the temperatures beneath undisturbed duff are much less marked than upon the temperatures where the duff has been disturbed or changed.

This graph shows that in July the canopy (40-year white-pine stand) held the maximum temperature to 13.2° C., while the removal of that canopy brought the temperature to 19.7° C. Therefore this canopy gives 6.5° C. of insulation to the base of the duff. The mere loosening of the duff at this same point raised the temperature an additional 7° C.

By lightly burning the undisturbed duff, it was found that the basal duff temperature was increased by 18.5° C., although scattered clouds caused intermittent sunshine from 10:45 a.m. until evening. The burning actually causes a much greater difference. The top duff was removed, and an increase of 26.5° C. was obtained, although scattered clouds interfered from 9 a.m. until 12:30 p.m. Intermittent cloudiness greatly lowered the maximum temperatures during the taking of some of these records at Harvard.

This graph of records beneath a 40-year stand shows less striking results than those obtained under the older stand near Headquarters, Idaho.

Graphs No. 7 and 8 show the temperatures on the opposite east and west slopes of a sharp ridge, beginning with the virgin mature stand and ending with the bare and burned slopes after clear-cut logging. This setting is shown in photographs W. 770 and W. 771 of this report.

The removal of the forest canopy caused the temperature to increase by 10° C. on the east slope and 14° C. on the west slope.

The removal of the top duff caused a further increase of 30° C. on the east slope and 20° C. on the west slope.

The removal of the basal duff caused a further increase of 5° C. on the east slope and of 1° C. on the west slope.

By lightly burning the undisturbed duff after the removal of the canopy an increase in temperature of 55° C. on the east slope and 40° C. on the west slope was obtained.

It is noted that the highest temperatures on the east slope occurred between 11 a.m. and 12:30 p.m. while the maxima on the west slope were from 1 to 4 p.m.

The Clearwater Timber Company has at Headquarters, Idaho, established a system of forest management controlling an area of several thousand acres. This partial cutting, on forestry principles, has been completed on some 1500 acres immediately adjoining the town. Portions of this area have been logged to a minimum diameter of 14" D.B.H. and other parts to a minimum of 17" D.B.H.

By lightly burning the undisturbed duff, it was found that the basal duff temperature was increased by 19.[illegible]° C., although scattered clouds caused intermittent shading from 10:35 a.m. until evening. The burning actually caused a much greater difference. The top duff was removed, and an increase of [illegible]° C. was obtained, although scattered clouds interfered from 9 a.m. until 12:30 p.m. Intermittent cloudiness greatly lowered the maximum temperatures during the taking of some of these records on Graph [illegible].

This graph of records beneath a 40-year stand shows less striking results than those obtained under the old-growth near head-quarters, Idaho.

Graphs No. 7 and 8 show the temperatures on the upper east and west slopes of a sharp ridge, beginning with the virgin mature stand and ending with the bare and burned slopes of a clear-cut logging. This setting is shown in photographs No. [illegible] and No. [illegible] of this report.

The removal of the forest canopy caused the temperature to increase by 10° C. on the east slope and 14° C. on the west slope.

The removal of the top duff caused a further increase of 30° C. on the east slope and 20° C. on the west slope.

The removal of the lower duff caused a further increase of 5° C. on the east slope and of 1° C. on the west slope.

By lightly burning the undisturbed duff after the removal of the canopy an increase in temperature of [illegible]° C. on the east slope and 40° C. on the west slope was obtained.

It is noted that the highest temperatures on the east slope occurred between 11 a.m. and 1:30 p.m. while the maxima on the west slope were from 1 to 4 p.m.

The Clearwater Timber Company has at Headquarters, Idaho, established a system of forest management controlling an area of several thousand acres. This partial cutting, or selective logging, has been completed on some 1500 acres immediately adjoining the town. Portions of this area have been logged to a minimum diameter of [illegible] D.B.H. and other parts to a minimum of 17" D.B.H.

Graph No. 9 shows the temperatures in the densest, the average and the most open parts of the 14" cutting area, with the typical temperature beneath similar virgin stands of the vicinity for comparsion. These are shown on the lower part of the graph with the duff undisturbed and on the upper part of the graph with duff which had been disturbed. The effect of duff disturbance is measured between the corresponding curves on the lower and upper parts of the graph.

Graph No. 10 shows the same data on the 17" cutting area, with the duff undisturbed.

These several graphs show that the soil temperatures, following clear-cut logging, reach maximum temperatures of from 25° to 55° C. on the unburned areas while the corresponding temperatures on the partial cutting areas are from 16° C. to 45° C. Except in the most open parts of these partial cutting areas, sustained temperatures exceeding 25° C. are very unusual.

The data thus far gathered show practically no Ribes seedlings starting in these partial cutting areas. There is a possibility that a practicable forest management plan which will, in itself, prevent the growth of Ribes, can be developed from these and additional data along similar lines.

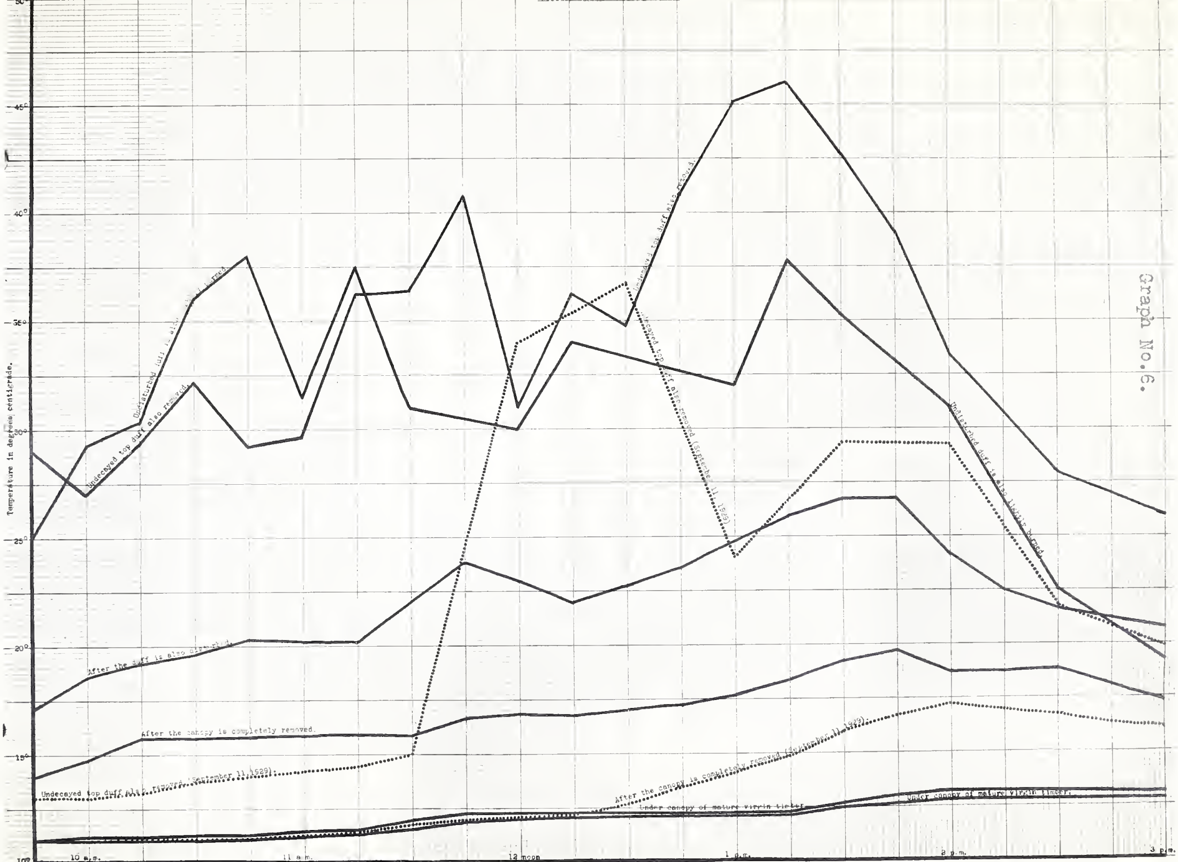
Graph No. 9 shows the temperatures in the average, the average and the most open parts of the 14% cutting area, with the typical temperatures beneath similar virgin stands of the vicinity for comparison. These are shown on the lower part of the graph with the duff undisturbed and on the upper part of the graph with duff which has been disturbed. The effect of duff disturbance is measured between the corresponding curves on the lower and upper parts of the graph.

Graph No. 10 shows the same data on the 17% cutting area, with the duff undisturbed.

These several graphs show that the soil temperatures, following clear-cut logging, reach maximum temperatures of from 55° to 60° C. on the unburned areas while the corresponding temperatures on the partial cutting areas are from 25° C. to 45° C. Except in the most open parts of these partial cutting areas, sustained temperatures exceeding 45° C. are very unusual.

The data thus far gathered show practically no Ribes seedlings starting in these partial cutting areas. There is a possibility that a practicable forest management plan which will, in itself, prevent the growth of Ribes, can be developed from these and additional data along similar lines.

SOIL TEMPERATURES AT BASE OF DUFF IN WHITE PINE STAND,
HARVARD, IDAHO, JULY 7-17, 1929.



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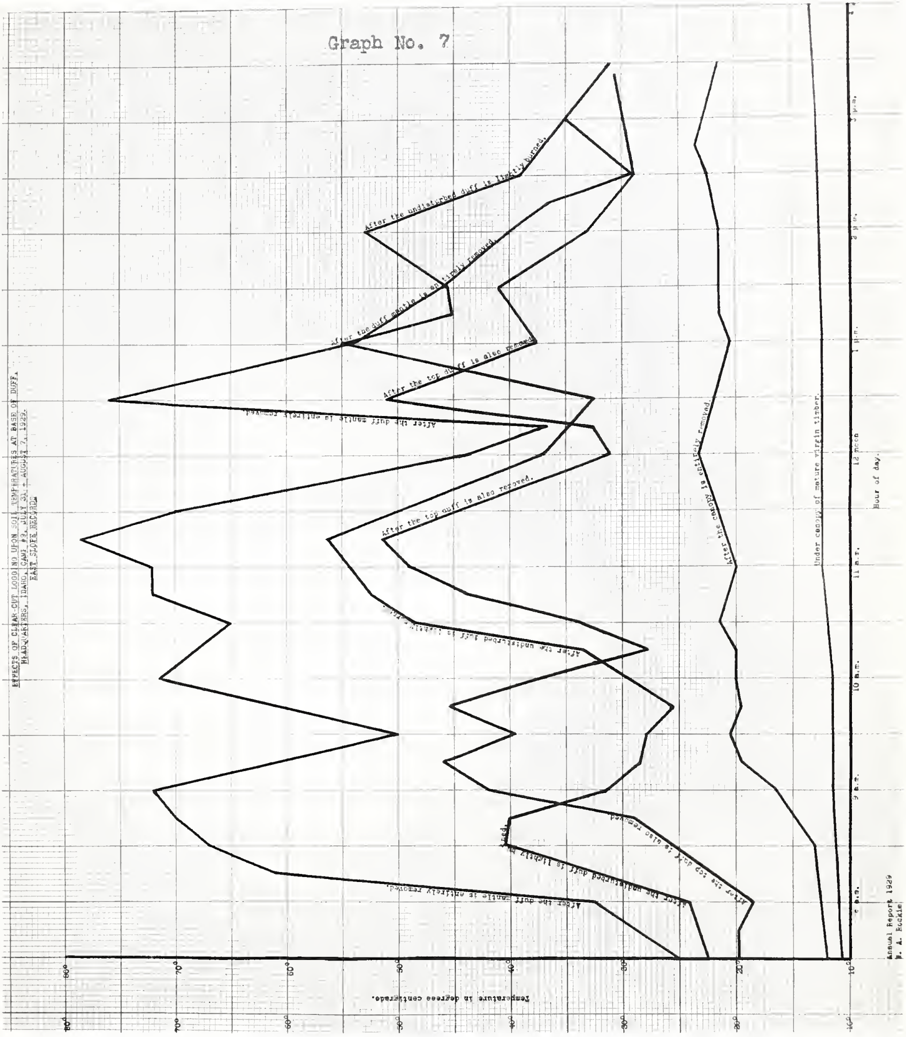
Graph No. 7


EFFECTS OF CLEAR-CUT LOGGING UPON SOIL TEMPERATURES AT BASE OF DUFF.
HEADQUARTERS, IDAHO, CAMP #3, JULY 31 - AUGUST 7, 1929.
EAST SLOPE RECORD
After the undisturbed duff is lightly burned.
After the duff mantle is entirely removed.
After the top duff is also removed.
After the canopy is entirely removed.
Under canopy of mature virgin timber.
Temperature in degrees centigrade.
Hour of day.
9 a.m.
10 a.m.
11 a.m.
12 noon
1 p.m.
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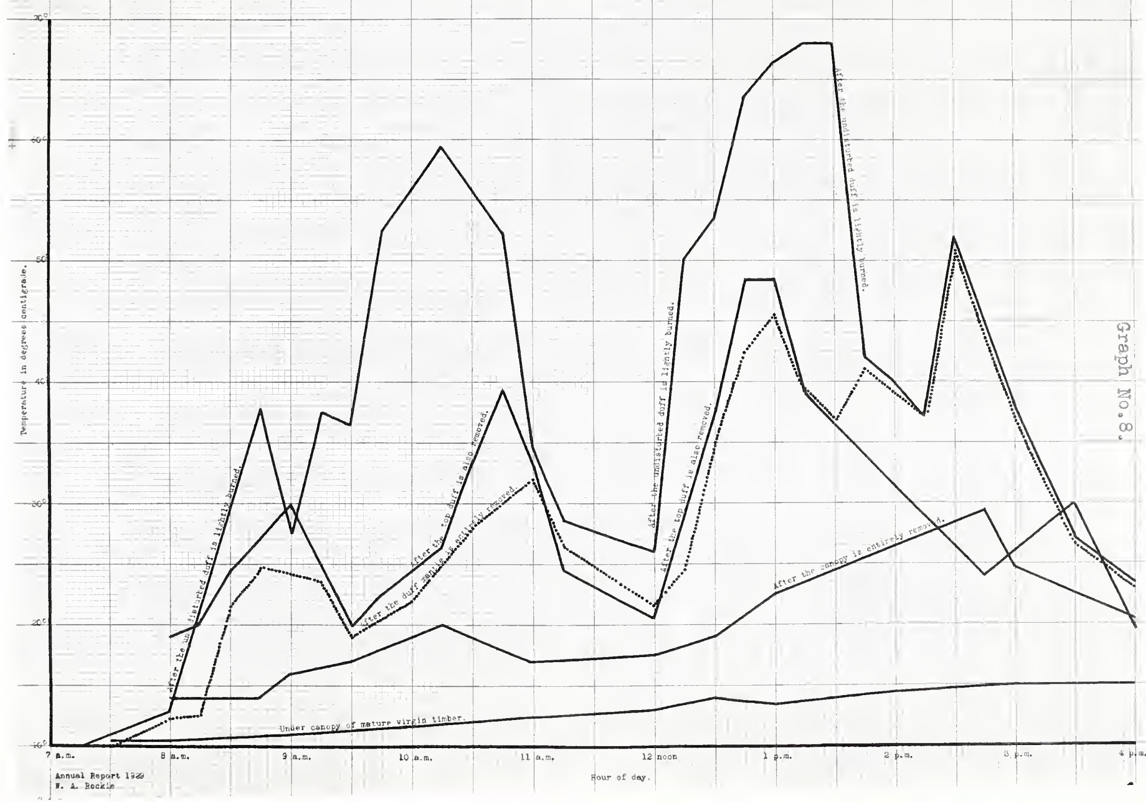
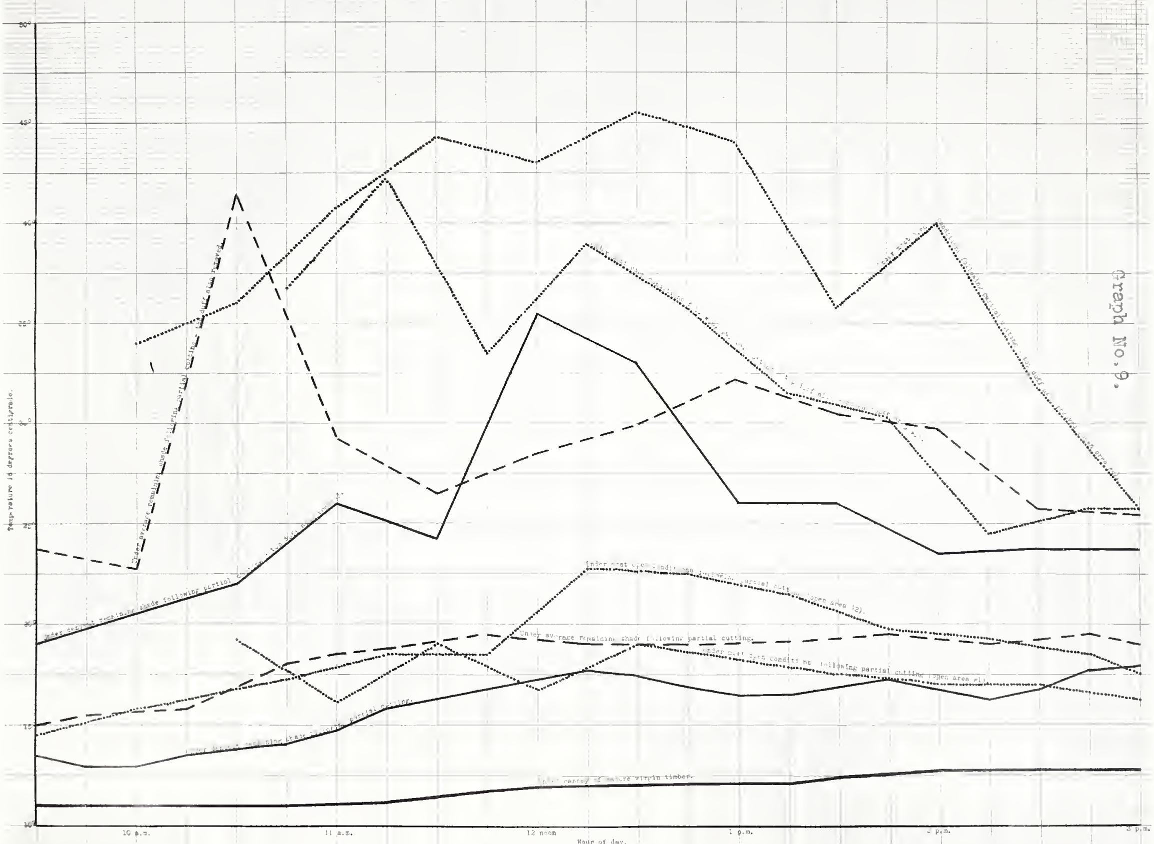
Graph No. 8.

EFFECTS OF CLEAR-CUT LOGGING UPON SOIL TEMPERATURES AT BASE OF DUFF.
HEADQUARTERS, IDAHO, CAMP #9, JULY 29 - AUGUST 7, 1929.
WEST SLOPE RECORDS



Graph No. 9.

SOIL TEMPERATURES AT BASE OF DUFF FOLLOWING LOGGING TO 14" DIAMETER LIMIT.
HEADQUARTERS, IDAHO, AUGUST 25-29, 1929.



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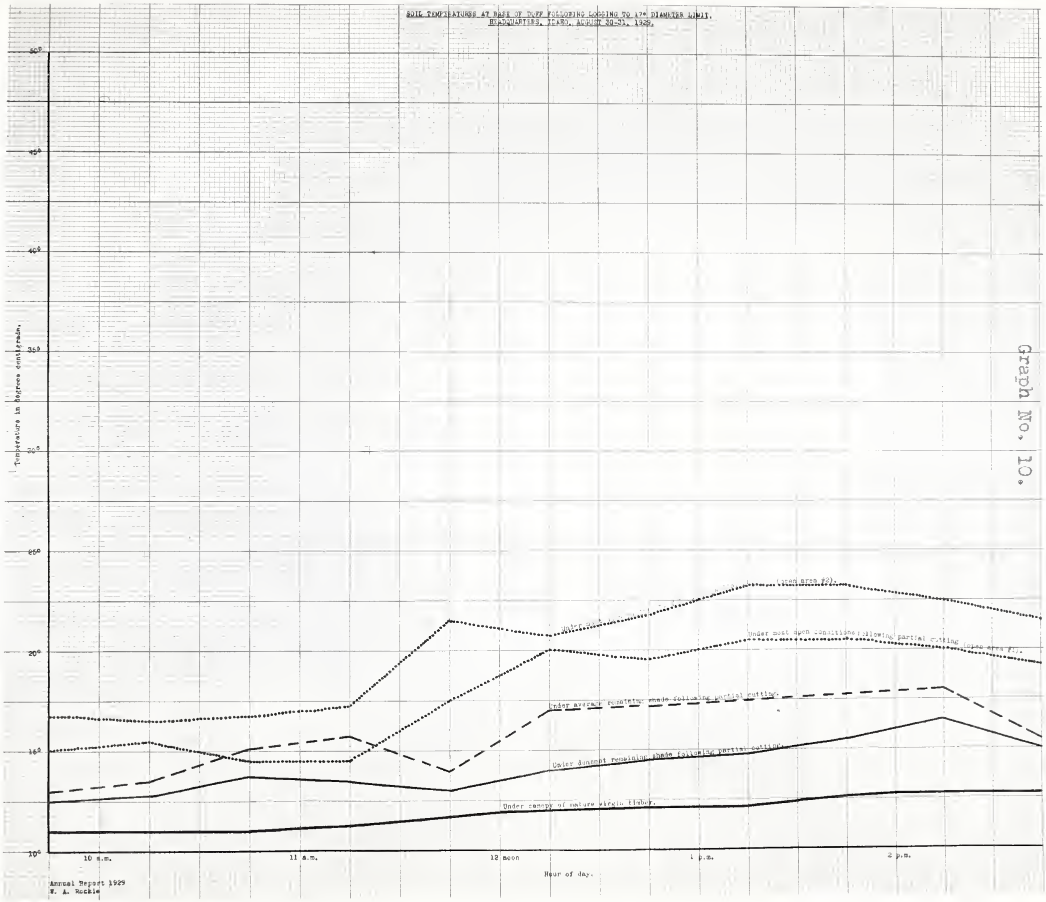


SOIL TEMPERATURES AT BASE OF DUFF FOLLOWING LOGGING TO 17" DIAMETER LIMIT.
HEADQUARTERS, IDAHO, AUGUST 30-31, 1929.
Graph No. 10.
Temperature in degrees centigrade.
50°
45°
40°
35°
30°
25°
20°
15°
10°
(open area #2).
Under most open conditions following partial cutting (open area #1).
Under average remaining shade following partial cutting.
Under densest remaining shade following partial cutting.
Under canopy of mature virgin timber.
10 a.m.
11 a.m.
12 noon
1 p.m.
2 p.m.
Hour of day.
Annual Report 1929
W. A. Rockie

G. SOIL ACIDITY INVESTIGATIONS

I. Definition

To measure the soil acidity in white-pine stands to determine any possible relations which may exist between the occurrence of Ribes and said soil acidity.

II. Methods

The quinhydrone potentiometer (Youden) was used for making determinations in acidity.

The technique of making these determinations was outlined in entire detail by Dr. Bollen of the Agricultural Chemistry Department of the University of Idaho. These directions were followed to the letter. To still further check these determinations, 34 determinations were made coincidentally on the quinhydrone potentiometer and on the standard hydrogen ion apparatus. This work was done by Dr. Bollen, G. L. Luke and the writer.

Fifty-eight determinations of acidity were made in the Clearwater region. Six of these were on burned soils, the remainder on varied unburned soils.

The acidity of the burned soils appears as variable as that of the unburned soils. No consistent relation appears between fire and increased soil alkalinity.

The average acidity of 52 unburned soils was 5.92. The average of 6 burned soils was 6.36. The range of acidity in the unburned soils was from 5.33 to 6.69, while the range in the burned soils was from 5.67 to 6.77.

No soil, even immediately after a heavy burn, with much ash in the sample, was alkaline.

This study apparently yielded no results.

Clear Cut Logging

W. 772 Without fire following logging.

W. 412 With fire following the logging. Inception of new Ribes in large numbers usually follows either procedure.

W. 770 East Slope.

W. 771 West Slope. These are taken at the point where the temperature records shown in Graphs 7 and 8 were taken. Nothing but cull trees were left standing after logging.

W. 765 Typical virgin stand before logging.

W. 763 Typical partial cutting area with 17" diameter limit.

765

763

W. 762 Showing local area with maximum proportion of the stand remaining.

W. 764 Showing local area with minimum proportion of the stand remaining.

REPORT ON CHECKING RIBES ERADICATION IN INLAND EMPIRE, 1929.

By
H. N. Putnam,
Associate Pathologist.

INTRODUCTION

The year 1929 saw the first large scale application of stream-type eradication of Ribes in north Idaho in which chemicals were used. Correspondingly, it was necessary for the first time to institute checking of stream-type eradication. Also for the first time the checking was done by an independent project, which had for its chief aim the determination of the effectiveness of the Ribes eradication expressed in terms of pine protection, rather than, as heretofore, the efficiency of the Ribes eradication work itself.

The study of effectiveness of control is conducted along two general lines, one of which deals with the effect of Ribes eradication upon the Ribes population, and furnishes the field of application. The second is concerned with the effect of the surviving Ribes upon the action of the rust.

This report covers the work done under the first heading, namely, the effect of Ribes eradication upon the Ribes population.

PURPOSE

The purpose of checking is two-fold: to determine (1) how many and under what conditions Ribes are left after eradication, and (2) the effect of eradication upon the Ribes population, particularly with reference to the best time for re-eradication.

LOCATION OF WORK

The following areas were checked in 1929:

1. Areas eradicated in 1929 on the lands of the Clearwater Timber Protective Association, Idaho, on the North and South Forks of Reed's Creek, and on Alder Creek.

2. Areas eradicated in 1929 on the holdings of the Potlatch Timber Protective Association, Idaho, namely, East Fork of Potlatch Creek, Gold Creek, Deep Creek and Meadow Creek.

REPORT ON CHECKING RIBES ERADICATION
IN [illegible] IDAHO, [illegible]

by

[illegible] Putnam,
Associate Pathologist.

INTRODUCTION

The year [illegible] saw the first large scale application of stream-type eradication of Ribes in north Idaho in which [illegible]. Correspondingly, it was necessary for the first time to [illegible] checking of stream-type eradication. Also for the first time the checking was done by an independent project, which had for its chief aim the determination of the effectiveness of the control application expressed in terms of pine protection, rather than, as heretofore, the efficiency of the Ribes eradication work itself.

The study of effectiveness of control is conducted along two general lines, one of which deals with the effect of Ribes eradication upon the Ribes population, and forecasts the need of reeradication. The second is concerned with the effect of the surviving Ribes on the action of the rust.

This report covers the work done under the first heading, namely, the effect of Ribes eradication upon the Ribes population.

METHODS

The purpose of checking is two-fold: to determine (1) how many and under what conditions Ribes are left after eradication, and (2) the effect of eradication upon the Ribes population, particularly with reference to the best time for re-eradication.

LOCATION OF AREAS

The following areas were checked in [illegible]:

1. Areas eradicated in [illegible] on the lands of the [illegible] Protective Association, Idaho, on the North and South Forks of [illegible] Creek, and on Alder Creek.

2. Areas eradicated in [illegible] on the holdings of the [illegible] Protective Association, Idaho, namely, [illegible] Creek, [illegible] Creek and Meadow Creek.

3. Areas on Lamb and Binarch Creeks, Kaniksu National Forest, Idaho, eradicated in 1926 and re-eradicated in 1928.

4. Savenac Nursery, Haugan, Montana, eradicated in 1928 and re-eradicated in 1929.

ORGANIZATION OF WORK

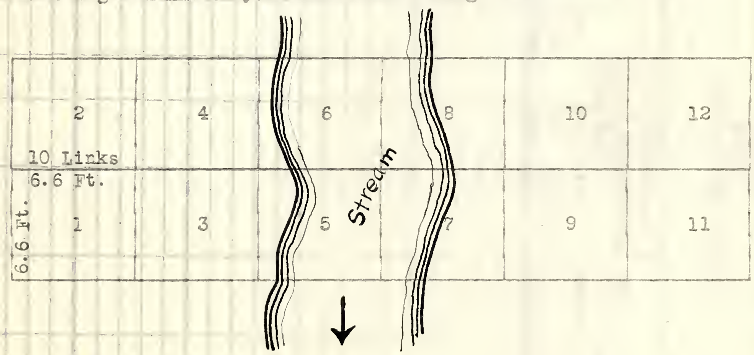
A. Methods.

Two general methods were used in the checking work: (1) by permanent plots, and (2) by temporary plots. These are discussed as follows:

1. Permanent Plots. Permanent plots were located at right angles to stream flow at 20-chain intervals on the main streams, by means of a stream traverse surveyed with compass and chain. Each plot was 13.2 feet or the width of two square milacres wide, and as long as the width of the stream type. This constituted a 1 per cent check of stream type.

Plots were established before eradication, and care was taken to mark them in such a manner that they would not be found by the eradication forces. The accompanying data sheet No. 15 shows the type of data taken. It may be noted that space is provided for five recordings on each plot.

The following diagram will show the procedure followed in numbering the Ribes by milacres containing them.



SAMPLE FORM

WF-BRC-#15-7/12/29

RIBES ERADICATION CHECK PLOTS

Project ____ Area ____ Camp ____ Plot No. ____

T. ____ R. ____ Sec. ____ | Date Eradicated ____ Foreman ____

Plot Location: ____ | Chemical Used ____ Method ____

| Ribes Density ____ Other Brush Density ____

| Remarks ____

Length ____ Width ____ True Bear. ____

Milacre No. and Ribes Species	Inspector	Date of Inspection		Original Ribes					Ribes Regeneration After Eradication			Per Cent Leaves Infected	Remarks: Reasons for survival, location of live stem etc.
		Month and Day	Year	Bush or Clump	Growth Form: Open, ½ Shade Shade	Area: Density Tenths	Area: Sq. Feet	Feet Live Stem	From Seed: No.	From Seed: Feet Live Stem	From Sprouts F.L.S.		

For example, if a R. petiolare bush was found in mil-acre No. 8, it would be called R. petiolare 8. If the next clump was in 11 it would be called R. petiolare 11. Small stakes on the center line were set at 10-link or 6.6-foot intervals and marked 1, 2, 3, 4, etc., reading from left to right. After eradication the plot was marked by larger permanent stakes. It is our intention to re-examine these plots at yearly intervals for several years.

2. Temporary Plots. After eradication streams not checked by the permenent-plot method were checked by temporary plots similar in size to the permanent plots but at 5-chain intervals. This constituted a 4 per cent check of stream type. The information was taken on form No. 40. On the back of this form a sketch map was made showing the stream checked, its tributaries and the location and number of check plots.

Information obtained on checking was turned over to the camp boss concerned with recommendations as to whether or not, in the opinion of the checker, the stream type was satisfactorily eradicated of Ribes.

B. Personnel Employed.

The field force consisted of four members of the permanent personnel and four temporary assistants. These men devoted all or part of their time to this project.

RESULTS OF WORK

The results of checking on areas eradicated in 1929 are shown following the report on the eradication area concerned. Results of checking on Lamb and Binarch Creeks and certain general results are shown here.

A. Statement of Checking Performed.

Table No. 1 constitutes a statement of all checking performed in 1929. In the temporary plot columns are included only the final check plots, and not first checking done on areas which had to be re-eradicated and again checked. In the grand total is shown only those permanent plots which were checked in 1929.

For example, if a R. petiolare bush was found in [illegible] 5, it would be called R. petiolare 5. If the next clump was in 11 it would be called R. petiolare 11. Small stakes on the center line were set at 10-link or 6.6-foot intervals and marked 1, 2, 3, 4, etc., reading from left to right. After eradication the plot was marked by larger permanent stakes. It is our intention to re-examine these plots at yearly intervals for several years.

2. Temporary Plots. After eradication streams not checked by the permanent-plot method were checked by temporary plots similar in size to the permanent plots but at 5-chain intervals. This constituted a 4 per cent check of stream type. The information was taken on Form No. 40. On the back of this form a sketch map was made showing the stream checked, its tributaries and the location and number of check plots.

Information obtained on checking was turned over to the camp boss concerned with recommendations as to whether or not, in the opinion of the checker, the stream type was satisfactorily eradicated of Ribes.

b. Personnel Employed

The field force consisted of four members of the permanent personnel and four temporary assistants. These men devoted all or part of their time to this project.

RESULTS OF WORK

The results of checking on areas eradicated in 1926 are shown following the report on the eradication area concerned. Results of checking on Lamb and Sinarch Creeks and certain general results are shown here.

A. Statement of Checking Performed.

Table No. 1 constitutes a statement of all checking performed in 1926. In the temporary plot columns are included only the first check plots, and not first checking done on areas which had to be re-eradicated and again checked. In the grand total is shown only those permanent plots which were checked in 1926.

SAMPLE FORM

WF-BRC-#40, 7/15/29

TEMPORARY RIBES ERADICATION CHECK STRIPS 13.2 FEET WIDE

Project ________________ Area ________________________________

T. ______ R. ______ Sec. ______ Checker ________________ Date ________

Stream Checked ____

Strip		Ribes			Eradi-	Remarks: Reasons for
	Length		Ft. Live		cation	survival, location of
No.	(chains)	Species	Stem	Shading	Method	live stem, etc.

TABLE NO. 1.

STATEMENT OF AMOUNT OF CHECKING DONE IN INLAND EMPIRE, 1929

Areas	Permanent Plots				Temporary Plots		Total Plots	
	Established		Checked					
	Plots	Mil-Acres	Plots	Mil-Acres	Plots	Mil-Acres	Plots	Milacres
Savenac Nursery - Montana					119	8,546	119	8,546
Lamb and Binarch Creeks, Kaniksu National Forest, Idaho					137	14,148	137	14,148
Clearwater Timber Protective Ass'n.	129	3,984	80	2,732	1,809	32,728	1,889	35,460
Potlatch Timber Protective Ass'n.	47	1,140	31	868	2,302	62,908	2,333	63,776
Totals	176	5,124	111	3,600	4,367	118,330	4,478	121,930

The reasons for survival of Ribes found by the checkers on eradicated areas of the two timber protective associations have been classified as shown in Table No. 2. The information under "Chemical Eradication" concerns R. petiolare while under "Hand Eradication" R. lacustre only has been so classified.

TABLE NO. 2.

CLASSIFICATION OF REASONS FOR SURVIVAL OF R. PETIOLARE AND R. LACUSTRE FOLLOWING ERADICATION

Type of Information	Chemical Eradication				Hand Eradication		
	Basis	Total Miss	Insuf. Spray	Under Water When Sprayed	Basis	Total Miss	Incom-plete Pull
Per cent of bushes	227 bushes	43%	41%	16%	2,444 bushes	90%	10%
Per cent of feet L.S.	4,119 F.L.S.	69%	23%	8%	37,487 F.L.S.	92%	8%
Ave. ft. L.S. per bush		29	10	9		16	12

TABLE NO. 1.

STATEMENT OF AMOUNT OF CHECKING DONE IN INLAND EMPIRE 193[illegible]

Areas	Permanent Plots Established Plots	Established Acres	Checked Plots	Checked Acres	Temporary Plots Plots	Temporary Acres	Total Plots Plots	Total Acres
Savenac Nursery - Montana					119	[illegible]	119	[illegible]
Lamb and Bingo Creeks, Kaniksu National Forest, Idaho					137	[illegible]	137	[illegible]
Clearwater Timber Protective Ass'n.	129	3,984	[illegible]	[illegible]	1,808	32,728	[illegible]	[illegible]
Potlatch Timber Protective Ass'n.	47	1,190	31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	176	5,124	111	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The reasons for survival of Ribes found by the checkers on eradicated areas of the two timber protective associations have been classified as shown in Table No. 2. The information under "Chemical Eradication" concerns R. petiolare while under "Hand Eradication" R. lacustre only has been so classified.

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Type of Information	Chemical Eradication Basis	Total Miss	Insuf. Spray	Under Water When Sprayed	Hand Eradication Basis	Total Miss	Incomplete Pull
Per cent of bushes	227 bushes	[illegible]	41%	16%	2,444 bushes	[illegible]	[illegible]
Per cent of feet L.S.	4,119 F.L.S.	69%	23%	8%	[illegible] F.L.S.	[illegible]	[illegible]
Ave. ft. L.S. per bush		59	10	9		[illegible]	[illegible]

The term "Total Miss" as used in Table No. 2, means that bushes so classified were not found by the eradicators. The terms "Insufficient Spray" and "Incomplete Pull" mean that the bushes were found but unsuccessfully eradicated. All of these terms express the human element in eradication and are avoidable.

The term "Under Water When Sprayed" includes growth from portions of stems under water when sprayed. When the water receded, leaves formed on these portions although the rest of the plants were killed. This is an unavoidable situation when the water is high. The most effective time of spraying in such situations is after the water has receded.

It is evident from Table No. 2 that a much higher per cent of bushes surviving eradication occurred as missed bushes under hand eradication of R. lacustre than under chemical eradication of R. petiolare. A possible basis for explanation lies in the fact that R. petiolare commonly was found as clumps while R. lacustre occurred as scattered bushes and consequently were harder to find.

In regard to missed R. petiolare bushes, a few instances were noticed during the season where entire eradication strips were missed. A crew would stop spraying at a certain string line at the end of the day and the following morning inadvertently start spraying at the wrong string line. This was easy to do because the effect of the previous day's spraying would not show up and all bushes looked alike because the dew would still be on. This oversight could be avoided by better marking the end of the sprayed area.

In Table No. 3 the "Total Misses" have been classified according to shading.

TABLE NO. 3.

BUSHES TOTALLY MISSED CLASSIFIED ACCORDING TO SHADING

Type of Eradication	Basis: Bushes or F.L.S.	Shading: Open	$\frac{1}{2}$ Shade	Shade
Chemical Eradication				
% of total missed bushes	97 bushes	60%	24%	16%
% of total missed F.L.S.	2,829 F.L.S.	48%	34%	18%
Average F.L.S. per missed bush		$23\frac{1}{2}$	42	32
Hand Eradication				
% of total missed bushes	2,204 bushes	13%	69%	18%
% of total missed F.L.S.	34,528 F.L.S.	14%	75%	11%
Average F.L.S. per missed bush		17	17	10

An examination of Table No. 3 shows the following facts:

1. The lowest per cent of misses by the chemical eradicators was in the shade, while in hand eradication the lowest per cent was in the open. Necessarily these figures are based on findings after eradication. To be truly significant we should also have the corresponding ratios of bushes growing in the different degrees of shading before eradication.

2. It may be observed that the smallest bush missed on chemical eradication was in the open while on hand eradication it was in the shade.

From data on the permanent check plots, we have derived an average figure showing the feet of live stem of R. petiolare and R. lacustre per square foot of actual area occupied by Ribes. The figures are shown below.

Total actual area of R. petiolare = 14,540.6 sq. feet.
Total F.L.S. of R. petiolare on above area = 143,562 F.L.S.
$\frac{143,562}{14,540.6}$ = 9.8 F.L.S. of R. petiolare per sq. ft. of actual area.

Total actual area of R. lacustre = 2,333.8 sq. ft.
Total F.L.S. of R. lacustre = 35,278 F.L.S.
$\frac{35,278}{2,333.8}$ = 15.1 F.L.S. of R. lacustre per sq. ft. of actual area.

These factors of feet of live stem of different Ribes species per square foot of actual area will be very useful. We are planning on using the square foot of actual area as an infection factor, hence any well-founded factor of feet of live stem per area unit will constitute a transition factor between feet of live stem and infection data, as well as an aid in estimating feet of live stem.

B. Results of Checking on Lamb and Binarch Creeks, Kaniksu National Forest, Idaho.

Certain areas on Lamb and Binarch Creeks were eradicated by hand in 1926 and portions were re-eradicated by hand in 1928.

Table No. 4 shows the results of checking on these areas.

TABLE NO. 4.

RESULTS OF CHECKING ON LAMB AND BINARCH CREEKS, KANIKSU NATIONAL FOREST, IDAHO.

Eradication		Number		Ribes F.L.S. Per Acre After Eradication		
Type	Status	Plots	Mil-acres	R.inerme	R.lacustre	Total
Stream	Eradicated 1926	18	2,460	1,557	114	1,671
Stream	Eradicated 1926, 1928	117	2,688	116	92	208
Upland	Eradicated 1926	1	5,800	0	20	20
Upland	Eradicated 1926, 1928	1	3,200	0	0	0

It is apparent from Table No. 4 that the great bulk of Ribes left after eradication was found in the stream type. It is also evident that the 1928 eradication was chiefly effective in the reduction in the amount of R. inerme in the stream type.

C. Results on Other Areas Checked.

The results of checking at Savenac Nursery, Montana and on the eradicated areas of the Clearwater and Potlatch Timber Protective Associations are shown following the reports on eradication on the respective areas.

FUTURE PLANS

It is expected that checking in 1930 will follow much the same plan as that used in 1929. However, it is planned not to do any checking by temporary plots until the eradication work is completely finished. Checking to find out how well the men are doing the work will and should be determined by men on the eradication projects. Checking by men on the "Damage to Pine" project will be done to form a basis for evaluating the work accomplished in terms of pine protection.

COSTS

The costs for the entire calendar year for the Damage to Pine project No. 4.2 is shown below. This includes the cost of checking and damage to pine study plots.

TABLE NO. 5.

COSTS OF PROJECT 4.2 FOR 1929

Item	Cost	Per Cent of Total
Salaries	$7,494.51	72.6
Subsistence	1,625.93	15.8
Personal Auto	683.15	6.6
Other Travel	298.27	2.9
Equipment	193.90	1.9
Miscellaneous	21.50	0.2
Total	$10,317.26	100.0

The salary item forms a high per cent of money spent on this project because it includes a large part of the time of three members of the permanent personnel for the entire year.

There is shown below an estimate of the money expended on each of the two major divisions of this project. Owing to the fact that work was done on each part by the same men at different times throughout the summer it was impractical to segregate items very accurately. The estimate, therefore, is simply a conscientious approximation.

Estimated cost of checking -	- $2,000.00
Estimated cost infection plots	- 8,317.26
Total	$10,317.26

RIBES ERADICATION IN NORTH IDAHO.

By

C. C. Strong,

Associate Forester.

The activities of the experimental Ribes Eradication Project in the Inland Empire, although varied in nature and function, are all aimed at the common object, namely, development of the most effective and cheapest method of destroying Ribes in stands of white-pine timber or in and around forest nurseries where white pine is grown for planting purposes. Cooperative Ribes eradication, first undertaken at Big Creek on the Priest Lake Timber Protective Association in 1928 and enlarged on the Potlatch and Clearwater Timber Protective Associations in 1929, is the first instance of Ribes eradication for purely protective purposes. The Ribes eradication project has taken the lead in (1) development of Ribes eradication methods and (2) assisting private and state timber owners in instituting Ribes eradication on a control basis to protect their own white-pine timber against damage by blister rust.

In 1929, plans for the Ribes Eradication Project were made to include those activities which had an immediate bearing on the most urgent problems. In view of the previous decision to institute Ribes eradication in stream type only as the first step in controlling blister rust, it was felt that experimental Ribes eradication on other than stream type could be suspended for 1929 in favor of more urgent experimentation. It should be borne in mind that stream type includes that area immediately bordering streams and perpetually damp places where in most cases an abundance of Ribes, highly susceptible to blister rust, grow. Destruction of Ribes from stream type, it was felt, would remove so much of the hazard from blister rust that the disease might never become established in many places if Ribes were not destroyed in time. Furthermore, even if the rust did become established the destruction of such a high percentage of the most susceptible Ribes might result in very little future damage to pine by the disease. Hence, in the following eradication reports the acreage shown as actually worked includes only stream type except where contrary procedure is specifically stated. Also acreages of white-pine timber shown as protected will, in all cases, include only that area drained by streams flowing through or contiguous to the stream type worked.

In all cases methods employed at the beginning of the 1929 season by any project were those most highly developed for similar work in the past. So much has been written in previous reports, especially in the 1928 report of the Western Office, about hand-pulling methods that very little further explanation regarding the same was

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felt necessary in the 1929 reports. In the case of spraying, both by knapsack and power, the methods are described in detail in two 1929 reports by H. E. Swanson.

Establishment of cooperative Ribes eradication on the lands of the Potlatch and Clearwater Timber Protective Associations offered one problem rather difficult of solution. A relatively large percentage of the acreage within the white-pine portions of the two associations is owned by people who, because they are financially unable, have no concern or because their lands may be heavily populated with Ribes and have little or no white pine, will not cooperate at the present time in financing Ribes eradication. Other owners were willing to help protect their own lands but were reluctant to assume the burden on other areas which, of course, would have to be worked if full protection was to be afforded all areas within a particular drainage. It was partially for the reason mentioned that the Federal Government consented to spend two dollars for each dollar spent by private owners in protecting such areas from damage by the rust instead of expending appropriations for cooperative work on the usual "dollar for dollar" basis.

Reports on the various activities of the eradication projects were written by the persons who supervised the work in the field except in cases where the men who supervised the field work were temporarily absent or assigned other duties. The reports, in the order in which they appear are as follows:

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1. Methods Employed in Chemical Eradication of Ribes...... [illegible]
2. Methods of Chemical Eradication........................ [illegible]
3. Records of Performance of Motors Used and Results of Test Runs.. [illegible]
4. Knapsack Spraying Equipment Report, 1929............... [illegible]
5. Experimental Stream Type Re-eradication................ [illegible]
6. Re-eradication of Ribes by Hand Pulling Methods, Idaho, 1929.................................... [illegible]
7. Experimental Application of Ribicides .... [illegible]
8. Pre-eradication Survey on Private and Federal White-Pine Lands... [illegible]
9. Cooperative Local Control, Clearwater Timber Protective Association.................................... [illegible]
10. Results of Checking on the Areas Eradicated of Ribes in the Clearwater Timber Protective Association, Idaho, 1929.............................. [illegible]

The report on "Experiments With Spraying Methods and Equipment, Morro Creek, California" by H. E. Swanson appears under the "General" heading near the end of the 1929 annual report of the Western Office.

METHODS EMPLOYED IN ERADICATING RIBES BY APPLYING TOXIC SPRAYS

By
C. C. Strong,
Associate Forester.

Some eradication of Ribes by means of applying toxic sprays was done by each eradication project in north Idaho in 1929. The amount of such work depended upon conditions encountered. The activities of each project are necessarily reported separately. In order to prevent duplication regarding spraying methods used the following description is here inserted rather than in each report. It is the aim to make this description of methods used apply to all projects except where special experiments made necessary a system or method peculiar to that project only. In that case detailed descriptions accompany the project report involved.

As men reported for duty they were placed on hand-pulling crews until they were familiar with the aims and purposes of the operation and acquainted with the various species of Ribes. In the region where work was being done _R. petiolare_, _R. lacustre_ and _R. inerme_ bushes grow intermingled but _R. petiolare_ bushes occur usually in heavy concentrations while bushes of the other two species grow more or less singly. All _R. lacustre_ and _R. inerme_ bushes were hand pulled, chiefly because no chemical had yet been found which would kill these bushes at a cost which was not prohibitive. _R. petiolare_ bushes are killed by applying a spray the basic component of which is sodium chlorate ($NaClO_3$). Atlacide, basically calcium chlorate and calcium chloride, is very effective when applied to this species. Hand pulling was the only operation on areas having no _R. petiolare_. On areas having _R. petiolare_, however, three operations were necessary, namely, spraying, hand pulling and (toward the end of the season) re-spraying along the water courses where some bushes were partially under water when original spraying was done and, hence, not killed.

Because very few men were available who had had previous experience with spraying methods as means of eradicating Ribes, it was possible to start only one spraying crew of 5 men at a time. When that crew was functioning smoothly, another was started and the practice continued until there was the proper balance between spraying and hand pulling. Matters were so arranged that all men got experience at both hand pulling and spraying during the season. Both methods of work have been described so frequently in previous reports that they will not be further discussed here except to say that the spraying crew consisted of 4 knapsack men and a foreman, while the hand-pulling crew usually numbered from 2 to 4 men including the foreman, depending on conditions encountered.

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Associate Forester.

Some eradication of Ribes by means of applying toxic sprays was done by each eradication project in north Idaho in [illegible]. The amount of such work depended upon conditions encountered. The activities of each project are necessarily reported separately. In order to prevent duplication regarding spraying methods used the following description is here inserted rather than in each report. It is the aim to make this description of methods used apply to all projects except where special experiments made necessary a system or method peculiar to that project only. In that case detailed descriptions accompany the project report involved.

As men reported for duty they were placed on hand pulling crews until they were familiar with the aims and purposes of the operation and acquainted with the various species of Ribes. In the region where work was being done R. petiolare, R. lacustre and R. inerme bushes grow intermingled but R. petiolare bushes occur usually in dense concentrations while bushes of the other two species are more or less singly. All R. lacustre and R. inerme bushes were hand pulled, chiefly because no chemical had yet been found which would kill these bushes at a cost which was not prohibitive. R. petiolare bushes are killed by applying a spray the basic component of which is sodium chlorate ($NaClO_3$). Atlacide, basically calcium chlorate and calcium chloride, is very effective when applied to this species. Hand pulling was the only operation on areas having no R. petiolare. On areas having R. petiolare, however, three operations were necessary, namely, spraying, hand pulling and (toward the end of the season) re-spraying along the water courses where some bushes were partially under water when original spraying was done and, hence, not killed.

Because very few men were available who had had previous experience with spraying methods as means of eradicating Ribes, it was possible to start only one spraying crew of 5 men at a time. When this crew was functioning smoothly, another was started and the practice continued until there was the proper balance between spraying and hand pulling. Matters were so arranged that all men got experience at both hand pulling and spraying during the season. Both methods of work have been described so frequently in previous reports that they will not be further discussed here except to say that the spraying crew consisted of 4 knapsack men and a foreman, while the hand-pulling crew usually numbered from 2 to 4 men including the foreman, depending on conditions encountered.

Two types of spray tanks were used. One was the curved-back type with the canvas back rest laced to the two flanges of the tank. (This tank has been patented by this office.) The other type is the flat slightly crescent-shaped tank which is strapped to a specially built "Trapper-Nelson" pack frame. This latter type, due partially to the lightness and flexibility of the unit and partially to the usefulness of the pack frame in packing chemicals and supplies to inaccessible areas, has proven the better of the two types.

The "Brown double-action hand pump" proved very much more satisfactory than the single-action pump used in previous work. A few minor changes will make it an excellent pump and one which will stand the severe treatment to which spraying equipment is subjected.

Atlacide was the chemical mixture mostly used for spraying R. peticlare. It was made into a solution by adding 1.4 pounds to each gallon of water. The agent mixed into the spray to cause it to spread evenly over and stick to the leaf surface was a stock solution made by dissolving one pound of flake glue in 3 gallons of water. A quantity of sodium chlorate ($NaClO_3$) and calcium chloride ($CaCl_2$) was left on hand from the previous season. Wherever this chemical was used for making spray it was used in the ratio $NaClO_3$ .9 pound, $CaCl_2$ .54 pound, water 1 gallon. The usual glue spreader and sticker was added.

Any area sprayed less than one hour before a heavy shower was resprayed because it was felt that the rain would wash off the chemical from the leaves before the desired absorption of toxic chemicals took place. However, there was so little rain during the 1929 field season that practically no respraying from this cause was necessary.

On all operations except the experimental chemical application unit at Clarkia, Idaho, it was aimed to have all spraying completed by September 1. It was feared that inefficiency might result from any spraying after that date due to decreasing anabolism in Ribes plants.

Heavy galvanized tanks of 10 to 14 gallons capacity were used during the season as mixing vessels.

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METHODS OF CHEMICAL ERADICATION

By
H. E. Swanson,
Agent

INTRODUCTION

In the chemical eradication of wild currants and gooseberries, a practical method of spraying with knapsack equipment had been developed during the 1928 season. All comparisons between work performed by this method with that performed by power equipment indicated that the knapsack method was the more practical. However, in the heavier concentrations of Ribes, the power method showed possibilities of being the better. In all previous work with power spraying equipment problems had been a handicap and had been detrimental to final results. During the 1929 season, all equipment was made uniform, auxiliary motors were available, and a capable mechanic was on hand to take care of any motor troubles which arose. The work was started on July 1 and completed on September 6, 1929.

PURPOSE

The principal purpose of the methods project was to place power spraying methods on a practical basis. This included the further development of suitable equipment for the power unit as well as the trial of a method of spraying. Subordinate to this aim were further studies in knapsack spraying along methods of work and improvement in equipment. However, this phase of the work was better taken care of in the other chemical eradication projects where all the work was performed with knapsack equipment.

LOCATION AND DESCRIPTION OF AREA

Musselshell Creek on the Clearwater National Forest in township 35 north and township 36 north, range 6 east of the Boise Meridian was the area on which the work was performed. Starting at the Musselshell Ranger Station, approximately eight miles of stream type was worked along Musselshell Creek itself, leaving the headwaters in section 23, township 36 north, range 6 east to be worked from a fly camp at a future date. Seven miles of this was worked by power spraying methods. The width of the stream type varied from two chains to fourteen chains, with the average between three and four chains. The concentration of Ribes was fairly uniform and would constitute about 15% of a complete ground cover. Ribes petiolare predominated, with a scattering of R. lacustre along the whole drainage and patches of R. inerme at the lower end of the area. The tributaries to Musselshell Creek were also worked. The largest of these, Gold Creek, was worked with knapsack sprayers. The other tributaries were eradicated by hand. The headwaters of Jim Brown Creek in sections 6 and 7, township 35 north, range 6 east, and also in

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the east half of section 31, township 36 north, range 6 east to the National Forest boundary was eradicated. There was approximately one mile of medium concentration of R.petiolare on this area which necessitated eradication by the use of knapsack sprayers.

A trail extending the entire length of the Musselshell Creek drainage made the area accessible for a pack string.

METHODS AND EQUIPMENT

This project consisted of a 15-man unit which size is very satisfactory for covering an area. A unit of this size has an advantage over a larger unit in that it eliminates the necessity of making frequent moves of the entire camp. At the same time it is possible to work all the stream from the main camp thus eliminating the additional cost and loss of time in establishing fly camps.

A. Power Spraying.

1. Advance work. With the aid of pre-eradication maps showing the Ribes concentration on the area, and with a pre-survey of the area by the supervisor in charge, the distribution of chemical along the drainage was made. Points along the trail designated as stations, were established and the amount of chemical to be left at these points was determined by the number of acres to be worked therefrom. These stations were established at points 1,500 feet to 1,800 feet apart along the trail, the exact location of each station being determined by the nearness of the stream to the trail and the suitability of the site at the stream for a motor set-up.

2. Power unit

a. Equipment.

2 motors (the second motor to be used in case of a breakdown).*
2,100 feet of ½" main-line pressure hose in 100-ft. sections, each section fitted with Bowes couplings.
3,000 feet of ¼" lateral pressure hose in 300-ft. sections.
400 feet of ¼" lateral pressure hose in 200-ft. sections.
22 Y couplings with shut-off valves.
10 trigger nozzles with special ball check and 4-ft. extensions.
4-14 gallon mixing tubs.
The entire unit can be loaded on a pack string of 8 mules.

b. Organization 13-man unit.

Foreman
Mechanic
Main-line hoseman
10 nozzlemen

*At the end of this report a record and an account of the performance of the various motors used in the project is given by B. A. Ganoung.

c. Method of work.

One motor is set up at the first station with two mixing tubs, one to be used as a solution tub for the intake hose of the motor and the other for a mixing container in which the chemical solution is prepared and then transferred to the other tub. It is the duty of the mechanic to operate the motor and mix the chemical.

The 2,000 feet of $\frac{1}{2}$" main-line hose is laid out along the area to be worked, with a Y coupling at each 100-ft. section. The position of the main-line hose is determined by the width of the stream type. In order to facilitate the work, it is essential to lay the main-line along one edge of the stream type when possible so that the men work on one side of the main-line only. This is possible where the stream type is not over 250 feet in width. In cases of a greater width the main-line is laid through the center of the stream type so as not to leave more than 250 feet on either side.* Areas greater than 500 feet in width are covered by putting out lateral hose lines from the main-line. Where a trail is present, it is often convenient to lay the main-line along the trail. There is sufficient main-line hose so that it is not all in use at the same time. This permits the bringing forward of the main-line from the lower end to be laid out ahead, thus making a continuous line of hose up the valley.

With 2,000 feet of main-line hose available, the line, when it is all moved ahead of the motor, will extend past the next station which is 1,500 feet to 1,800 feet above. With two mixing tubs filled with solution, everything is then ready for moving the motor. This move requires about 15 or 20 minutes and is made during the noon hour or after the close of operations at the end of the day's work in order to prevent any loss of time on the part of the nozzlemen.

The actual spraying is done by the 10 nozzlemen who are each provided with a 300-ft. $\frac{1}{4}$" lateral hose, with a ball check, trigger nozzle, and 4-ft. extension on one end and a Bowes coupling on the other end permitting the hose to be attached to the main-line. Each man is assigned a section of stream type 100 feet wide at right angles to the main-line and extending the entire width of the stream type. The nozzleman will work his area by strips running perpendicular to the stream and main-line. The first strip is marked out with string lines for him. He sprays this strip and when out at the end, he detaches his nozzle above the ball check, and returns to the main-line, laying a string line to mark off his next strip as he goes. Then he pulls in his hose line, merely piling it as he goes. Following that he puts on the nozzle and is ready to spray the next strip. His entire section is worked out in this manner. On completing a section the nozzleman takes his hose and moves up to the next unassigned section along the main-line.

*The illustration following this report shows the methods of dividing and spraying an area.

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Irregularities in the stream type are handled in various ways and some experience in the work is necessary for this. In narrow stream type it is often necessary to assign 200-ft. sections and spray an area by strips running parallel to the creek. Laterals can be laid out to extend up side draws or tributaries where concentrations of Ribes are heavy.

B. Knapsack Spraying.*

The knapsack work was performed on areas which were obviously too light in Ribes concentration for power equipment. The individual section system was used.

Two types of spray tanks were given a trial, one with a back rest attached, the other attached to a Trapper Nelson Indian pack frame. The latter proved to be the most satisfactory from the standpoint of comfort and ease in carrying and also from the general utility of the pack frame which could be detached from the tank and used for general packing. For durability this tank is equal to the other, and is of simpler construction, which renders its initial cost much less.

The Brown double-action pumps proved satisfactory. There were certain minor defects which became noticeable in the heavy and severe treatment the pumps were given in the brush. These features can be easily remedied by minor changes in the construction of the pump.

The canvas sacks were very satisfactory for carrying chemical, when it was necessary to man-pack.

Two 10-gallon collapsible canvas buckets were given a trial as mixing containers. Although these buckets were used for a period of 15 days only they show very little wear. Their light weight and compactness make them desirable for use on areas which are more or less inaccessible. They would facilitate any knapsack work from this standpoint. Another feature which makes them desirable is that twenty or thirty of them can be loaded upon one pack animal. This type of mixing container will warrant an extensive trial next season.

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Two 10-gallon collapsible canvas buckets were given a trial as mixing containers. Although these buckets were used for a period of 10 days only they show very little wear. Their light weight and compactness make them desirable for use on areas which are more or less inaccessible. They would facilitate any knapsack work from this standpoint. Another feature which makes them desirable is that twenty or thirty of them can be loaded upon one pack animal. This type of mixing container will warrant an extensive trial next season.

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RESULTS OF WORK

TABLE NO. 1.

SUMMARY OF CHEMICAL ERADICATION PERFORMED ON MUSSELSHELL AREA 1929

Method	Ribes Concentration	Man-Days	Gallons Chemical	Acres	Data Per Acre Man-Days	Data Per Acre Gallons Chemical	Data Per Acre Cost	Total Cost
Power	Medium	370.5	10,893	270	1.35	40.3	$24.79	$6,693.19
Knapsack	Light	78.5	1,464	99	.79	14.8	11.91	1,179.21
Total		449.0	12,357	369	1.22	33.5	$21.33	$7,872.40

TABLE NO. 2.

SUMMARY OF HAND ERADICATION PERFORMED ON MUSSELSHELL AREA - 1929

Type	Man-Days	Acres	No. Ribes Pulled R. lac.	R. pet.	R. vis.	R. iner.	Total Ribes	Data Per Acre Man-Days	Ribes	Cost	Total Cost
Stream	136.5	373	40,613	23,466	873	809	65,761	.37	176	$4.46	$1,662.99

TABLE NO. 3.

SUMMARY OF ALL ERADICATION PERFORMED ON MUSSELSHELL AREA - 1929.

Man-Days	Pounds Chemical	Acres Eradicated	Cost	Acres Protected	Per Cent of Area Stream Type	Cost Per Acre to Eradicate	Cost Per Acre to Protect
585.5	17,250	742	$9,535.39	11,150	6.65	$ 12.85	$0.89

TABLE NO. 4.

STATEMENT OF COSTS.

I t e m		Cost
Salaries	Supervisors	$2,471.34
	Temporary men	2,098.30
Subsistence	Salaries of cooks	275.00
	Cost of food	969.01
	Transportation of food	221.90
General Equipment	Cost	229.12
	Transportation	139.67
Spraying Equipment		785.01
Miscellaneous	Supplies	57.18
	Expenses	150.20
	Repairs	384.12
	Twine	38.26
Chemical	Cost	1,381.16
	Transportation	141.45
Transportation of men		193.67
Total		$9,535.39

TABLE NO. 5.

COST OF MEALS SERVED.

Cooks' salary and expenses.	$275.00
Cost of food used	969.01
Cost of transporting subsistence supplies	221.90

Total cost subsistence $1,465.91
Total number meals served . . . 2,964
Average cost per meal $0.495

CONCLUSION

The results of the work performed by the power unit, together with actual observation of the work, indicate that there is a field for this type of unit. Areas similar to Musselshell Creek, with a wide stream type and heavy concentration of Ribes, can be eradicated at a low cost with the power equipment. It is possible and it is also recommended that power units be organized to eradicate areas comparable to the Musselshell area, even though the total acreage to be so eradicated amounts to only 75 or 100. The power unit can be adapted to this size of an area by reducing the 13-man unit to a 7-man unit, requiring

only one-half of the amount of equipment used in the large unit. The same method of spraying would be used, the only change being the decrease in the distance between stations, which is not a factor that will affect costs to any appreciable extent. The office possesses two single-cylinder motors which will handle satisfactorily this size of a unit.

Although considerable progress has been made in adapting spraying equipment to blister-rust-control work, there are certain features which are yet to be improved. The principal difficulty seems to be in getting a type of equipment which will stand the severe treatment which necessarily results from performing the work in the brush. Efforts are being made to remedy the defects, and also to find some method with which to treat the equipment in order to preserve it against any action from the chemical.

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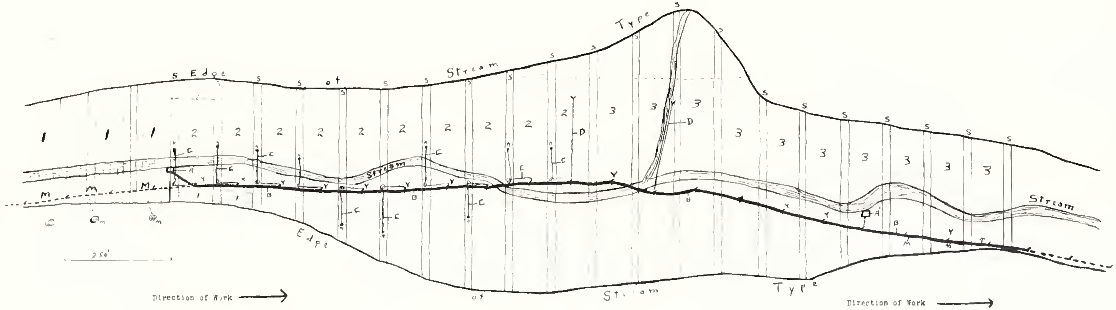
DIAGRAM OF METHOD EMPLOYED BY POWER UNIT



A - Power station.
A' - Next power station. Motor to be moved up at noon or at end of day's run when nozzlemen are on all blocks up to A'.
B - Main line hose - 2,000 feet of 1/2" pressure hose in 100-foot sections.
M - Main line hose moved up from rear end of line to head of line after area has been sprayed. In this manner a continual line is maintained in advance of the unit.
Y - Y couplings at end of each 100-foot section of main line hose. Each Y having two shut-off valves permitting the flow of solution to be regulated in lateral outlet and also along main line.
C - Lateral hose line - 1/4" pressure hose in 300-foot sections. Allows a distance of 250 feet away from main line, as 50 feet is required to extend across the block.
N - Ten nozzlemen supplied with 300-foot section of 1/4" hose and nozzle, working first strip in block assigned to them. Block includes all area between the strip being worked and next strip to the right. Nozzlemen detach nozzle when they reach edge of stream type and then return to main line, laying out the next strip with string as they return. At the main line, they pull in their lateral hose to start in on next strip.
S - Strips laid out with string line by hose line man.
1 - Blocks completed.
2 - Blocks in process of being sprayed.
3 - Blocks laid out in advance ready for nozzlemen when they complete blocks on which they are working.

Note: Main line is laid along edge of stream type where width permits, so that the whole length of the strip can be worked with only one detatchment of the nozzle. Method explained in detail in body of report.

When the knapsack method of spraying was employed strips were usually laid out in the manner shown above for power spraying. Filling stations were set up as nearly on the dividing line between two strips as was convenient.

RECORD OF PERFORMANCE OF MOTORS USED AND RESULTS OF TEST RUNS

By
B. A. Ganoung,
Agent.

PERFORMANCE RECORDS

Pacific Marine Unit A-1

Motor - 2-cylinder, 2-cycle, "Johnson Outboard" type.
Pump - Centrifugal, 5 gallons per minute at 100 pounds pressure.
Ignition - Magneto in fly-wheel.
Operation in field - 8 hours 1929, 117 hours previous, 125 hours total.
Troubles 1929 - Connecting rod thrown through crankcase; crankshaft scoured; piston skirt broken.
Changes and repairs - Unit system changed from air-cooled to solution-cooled before used in field in 1929.
Performance - Unsatisfactory.

Ross #10, Type L-1.

Motor - 2-cylinder, 2-cycle, "Elto heavy-duty outboard" type.
Pump - Hi-duty, small rotary, 4 gallons per minute at 100 pounds pressure.
Ignition - Battery with open circuit timer.
Operation in field - 77 hours 1929, 75 hours previous, 152 hours total.
Troubles 1929 - Crankshaft broke in fly-wheel at end of 70 hours operation. Connecting rod crystallized at end of 77 hours run.
Changes and repairs - New crankshaft, main bearings, piston rings, fly-wheel and universal points installed at end of 70 hours run. New pistons, wristpins and crankshaft installed at end of 77 hours run. Unit changed from water hopper-cooled to solution-cooled before start of field work 1929.
Performance - Fairly satisfactory.

Pacific Marine #1708 Type N Fire Fighter

Motor - 4-cylinder, 2-cycle "Johnson Outboard" type.
Pump - 35 gallons per minute at 175 pounds pressure. "Northern Semi-centrifugal".
Ignition - Magneto in fly-wheel.
Operation in field - 116 hours 1929 - purchased July 1929.
Gas and oil consumed - 70 gallons with 3/4 pint oil in each gallon of fuel.
Troubles - None.

Changes - Large capacity by-pass installed to allow recirculation of surplus solution pumped.

Ross B.R.C. Units No. 11 and 12.

Motor - 1-cylinder, 2-cycle "Cushman Bob-a-lawn" type, geared 4 to 1.
Pump - Ross, 2-stage rotary, 5 gallons per minute at 100 pounds pressure.
Ignition - Gear driven "Boesch" magneto.
Operation in field - 25 hours each 1929 on test work and approximately 105 hours each previous, 130 hours each total.
Changes and repairs - New water jacket cylinders cast for these units, the old air-cooling systems discarded.

Test Runs

Testing nozzle capacity of 1/4" air hose as main line.

Test made with 1,000 feet 1/4" air hose main line and 5-300 ft. laterals of same size attached at 600, 700, 800, 900 and 1,000 ft. marks respectively, nozzle No. 1 being nearest the motor, etc.

Results

Pressure at motor 105 pounds.
Pressure at end of main line with all nozzles closed, 105 pounds.
Pressure at end of main line with nozzle No. 1 opened, 70 pounds.
Pressure at end of main line with nozzles 1 and 2 opened, 50 pounds.
Pressure at end of main line with nozzles 1, 2 and 3 opened, 30 pounds.
Pressure at end of main line with nozzles 1, 2, 3 and 4 opened, 10 pounds.
Pressure at end of main line with all nozzles opened 0 pounds.

There was not sufficient pressure at nozzle No. 5 when nozzles 1, 2 and 3 were open, practically no film of spray when nozzles 1, 2, 3 and 4 were open and no spray at all when all 5 nozzles were open. Ross B.R.C. motors No. 11 and 12 used on run.

Testing $\frac{1}{2}$" main line in contrast to $\frac{1}{4}$" main line with same layout.

Results

Pressure at motor, 105 pounds.

Pressure at end of main line with all nozzles closed, 105 pounds.

Pressure at end of main line with nozzle No. 1 open, 100 pounds.

Pressure at end of main line with nozzles 1 and 2 open, 87 pounds.

Pressure at end of main line with nozzles 1, 2 and 3 open, 80 pounds.

Pressure at end of main line with nozzles 1, 2, 3 and 4 open, 74 pounds.

Pressure at end of main line with all nozzles open, 70 pounds.

Ross B.R.C. motors No. 11 and 12 used.

KNAPSACK SPRAYING EQUIPMENT REPORT, 1929

by
Frank Breakey
Agent

INTRODUCTION

The results of experimental application of chemical eradication of wild Ribes in north Idaho during the field season of 1928 together with chemical eradication methods studies, clearly demonstrated the need of more efficient chemical eradication equipment.

PURPOSE

The purpose of this type of experimental work was the development of better equipment for the chemical eradication of wild currants and gooseberries, the ultimate objectives being to lower the cost of operation and to increase the efficiency of the work.

SPRAYING EQUIPMENT USED BEFORE JANUARY 1, 1929

During the field season of 1925 a three-gallon hand operated compressed air sprayer was used at Wallace and Santa, Idaho on experimental studies in the chemical eradication of Ribes. In 1926 a brass knapsack tank sprayer with rectangular ends, having a capacity of four gallons, was purchased in preference to the compressed air sprayer. The D. B. Smith Company one-way hand operated, trombone pump was used. The following year the D. B. Smith Company five-gallon galvanized iron knapsack tank was also given extensive use. The D. B. Smith trombone pump was given a second trial.

In 1928 a great deal of experimenting was done on the development of power spraying equipment and methods. The same knapsack equipment was used in 1928 as in 1927. At this time, however, it became evident that a smaller, more compact and more portable unit was necessary for use on knapsack spraying crews.

CHEMICAL ERADICATION EQUIPMENT IMPROVEMENT

Methods Employed.

1. Extended study of apparatus already in existence.

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Frank Bieskey

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CHEMICAL ERADICATION EQUIPMENT DEVELOPMENT

Methods Employed.

1. Extended study of apparatus already in existence.

TABLE NO. 1

COMPARISON BETWEEN VARIOUS TYPES OF EQUIPMENT USED IN KNAPSACK SPRAYING OF RIBES TO CONTROL WHITE-PINE BLISTER RUST AS DETERMINED BY EXTENSIVE INVESTIGATION AND TESTS

Item Tested	Manufacturers	Mechanical Construction	Comparative Operating Ease	Construction Not Suited to Our Purpose	Comparative Weight	Comparative Length of Life	Greatest Strain Subjected	Average Working Strain
A. Knapsack tanks.	D. B. Smith Co.	Galvanized sheet metal. Knapsack tank.	Difficult.	Protruding edges, seams gave way.	Medium.	Short.	40# load.	35# load.
		Brass knapsack tank.	Difficult.	Shape not suited for carrying.	Light.	Short.	40# load.	35# load.
B. Canvas knapsack.	Office of Blister-Rust Control direction - samples.	Waterproof duck.	Easy.	Canvas porous, leaked chemical.	Light.	Long.	50# load.	40# load.
		Canvas duck waterproofed after manufacture.	Easy.	Canvas porous, leaked chemical.	Light.	Long.	50# load.	40# load.
C. Packboards.	Charles Trager.	Wooden frame, canvas cover.	Easy.	Long projecting ends.	Light.	Long.	150# load.	40# load.
	Clack-pack frame.	All wood.	Difficult.	Uncomfortable.	Light.	Long.	100# load.	40# load.
	Office of Blister-Rust Control direction - samples.	Wooden bows, wire cover.	Easy.	Cuts clothing, wire breaks.	Medium.	Short.	150# load.	40# load.
		Channel iron bows, wire covering.	Easy.	Cuts clothing, wire breaks.	Medium.	Short.	150# load.	40# load.
		Channel iron bows, canvas cover.	Easy.	O.K.	Light.	Long.	150# load.	40# load.
		Wooden bows, canvas cover.	Easy.	O.K.	Light.	Long.	150# load.	40# load.
		Strap iron - fibre board cover.	Variable.	Fibre drew dampness.	Medium.	Short.	150# load.	40# load.
		Fibre board - no supports.	Variable.	Fibre drew dampness.	Medium.	Short.	150# load.	40# load.
D. Pack straps.	Office of Blister-Rust Control direction - samples.	Webbing, 1 and 2 inch heavy.	Easy.	O.K.	Medium.	Long.	150# load.	40# load.
		Webbing 1 inch light.	Variable.	Rolled.	Light.	Short.	50# load.	40# load.
		Leather 2 inch medium.	Variable.	Edges cut.	Medium.	Long.	150# load.	40# load.
		Tubular pneumatic 2 inch heavy.	Variable.	Rough, hot.	Heavy.	Long.	150# load.	50# load.
E. Trombone pumps.	D. B. Smith Co.	Single acting.	Difficult.	Extension tip.	Heavy.	Short.	75# pressure.	35# pressure.
	E. C. Brown Co.	Double acting.	Easy.	Extension tip re-paired.	Light.	Long.	200# pressure.	50# pressure.
	R. D. Hudson	Double acting.	Variable.	Valves - extension tip.	Medium.	Short.	200# pressure.	50# pressure.
	Utility Sprayer Co.	Double acting.	Variable.	Valves - extension tip.	Medium.	Short.	200# pressure.	50# pressure.
F. Nozzles.	D. B. Smith Co.	Pressed brass - golden spray, straight stream.	Variable.	Threads stripped.	Light.	Short.	75# pressure.	35# pressure.
	Utility Sprayer Co.	Cast brass - angle nozzle No. 80.	Easy.	O.K.	Light.	Long.	200# pressure.	50# pressure.
G. Nozzle extensions for trombone pump.	D. B. Smith Co.	Brass - 2 feet x 1/8 inch.	Easy.	Soldered ends gave out.	Light.	Short.	75# pressure. 50# side strain.	35# pressure. 10# side strain.
	Office of Blister-Rust Control direction - samples.	Iron - 2 feet x 1/4 inch pipe.	Difficult.	O.K.	Heavy.	Long.	75# pressure. 50# side strain.	35# pressure. 10# side strain.
		Iron - 2 feet x 1/8 inch pipe.	Easy.	O.K.	Light.	Long.	200# pressure. 50# side strain.	50# pressure. 10# side strain.
		Iron - 3 feet x 1/8 inch pipe.	Variable.	Unwieldy on pump.	Medium.	Long.	200# pressure. 50# side strain.	50# pressure. 10# side strain.
		Iron - 4 feet x 1/8 inch pipe.	Variable.	Unwieldy on pump.	Heavy.	Long.	200# pressure. 50# side strain.	50# pressure. 10# side strain.
H. Compressed air pressure sprayer.	Utility Sprayer Co.	Compressed air single chamber cylindrical - 3 gallons.	Variable.	No check on pressure. Unhandy to carry.	Medium.	Short.	85# pressure.	40# pressure.
	Pacific Marine Supply Co.	Compressed air double chamber knapsack shape - 5 gallons.	Difficult.	Valve attachments faulty - reducing valve cumbersome.	Heavy.	Short.	2000# small chamber. 50# large chamber.	2000# small chamber. 35# large chamber.
		Compressed air two chambers cylindrical - 4 and 1 gallon.	Difficult.	Reducing valve cumbersome - unhandy to carry.	Heavy.	Long.	160# small chamber. 35# large chamber.	160# small chamber. 35# large chamber.
I. Chemical mixing vats.	Van Deusen Whip Co.	Metal frame, canvas cover.	Easy.	O.K.	Light.	Undetermined.	10 gallons.	10 gallons.
	Office of Blister-Rust Control direction - samples	Copper and sheet iron wash boilers.	Variable	Will not nest.	Medium.	Long.	14 gallons.	12 gallons.
		Wash tubs.	Easy.	O.K.	Medium.	Long.	14 gallons.	12 gallons.

Annual Report 1929
J. F. Breakey

a. Morro Bay, California tests (see Swanson's Report).

2. Development of new equipment suited to the needs of chemical eradication in the forests of the Northwest.

Aim - To build and assemble a light, strong, easily operated unit, dependent only on the activity and care of one man in the field, capable of doing an efficient spraying operation even on the most inaccessible areas.

3. Results - Description of units with reference to prints.

a. Pump.

Figures 1, 2 and 3 of the accompanying prints explain the working parts and the general appearance of the Brown pump manufactured by the E. C. Brown Company, Rochester, New York and rebuilt according to our direction before being sent into the field.

Examining the drawing it will be noted that the pump Fig. 1 has a cylindrical shape with a nozzle on extension mounting tip 22 and tail piece 3 as its two end extremities. Packing nut 2 and tail piece 3 are threaded on barrel 4. Plunger 5 passes through packing nut 2 and is secured by ring 17 and pin 16 from injuring leather cup washer 8 when in operation. Graphite packing ring 19 held in place by stop ring 18 and packing nut 2 insures against leaking. Barrel 4 is indented just above where tail piece 3 is threaded to hold perforated stop washer 11 and leather sealing washer 12 in position, perforated stop washer 11's function, being, to hold the ball check above opening 13 in place. Plunger 5 has a rectangular opening 15 cut through the side of the copper tube, three of the edges being cut and the severed piece pressed to a right angle with the tube, this projection serving to hold the ball check above opening 14 in place. A threaded valve base 6 serves as a seat for the valve above opening 14. The leather cup 8 is held in position by a threaded seat 7 enlarged to add strength and support. Extension tip 22 was first soldered on plunger 5 but later removed and brazed according to our directions. Two close-fitting wooden handles 21 are soldered to the plunger and barrel by means of a thin copper sleeve attached at both ends. Both handles are the same size. All metal parts are brass.

Operation of the pump - The course of the chemical fluid through the pump is as follows: On the outward (expansion) stroke of the plunger the liquid enters the ball check valve through opening 13 (14 closed by the automatic action of pressure) passes through the perforated stop washer 11 and fills the barrel 4. The expansion stroke continues until plunger stop ring 17 strikes packing stop ring 18. During this operation the liquid around plunger 5 is forced through the rectangular opening 15 by the action of the valve above opening 14 and cup washer 8. The liquid passes into the inside of the plunger and out through nozzle attached at 22. At the completion of the expansion stroke the barrel is completely filled with liquid. When the first impulse of a reverse action of the plunger takes place, the ball check valve above opening 13 closes, and the plunger displacement on the compression stroke forces the excess liquid in the barrel through the nozzle end. On the compression stroke the valve at 14 and the cup washer are both open, filling the upper chamber for the next succeeding stroke as well as allowing the excess fluid to flow out through the nozzle end of the pump.

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INDEX TO FIGURES

1 - 2 - 30

DRAWN BY John F. Breakey OFFICE OF BLISTER-RUST CONTROL

PUMP

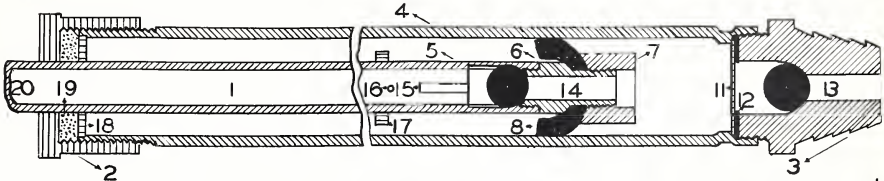


FIG. 1

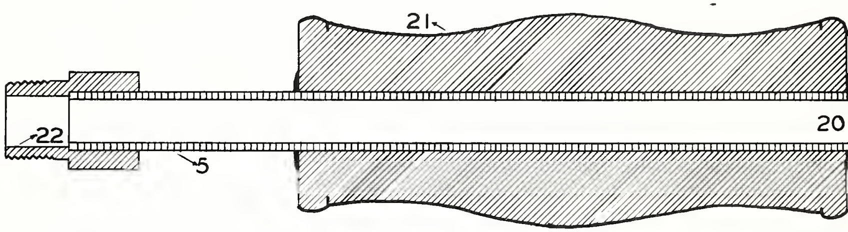


FIG. 2

FIG. 3

DRAWN BY John F. Breakey OFFICE OF BLISTER-RUST CONTROL 11-20-29

b. Knapsack.

Figures 4 and 5 show a top plan view and a perspective view (backrest, lacing, and pack straps indicated) of the knapsack constructed and used during the past field season by the Office of Blister-Rust Control. Tank 1 has a convex wall 2 and a concave wall 3 with top 4 and bottom 5. The concave wall has apertured extensions 6 adapted to receive laces 7. Lacing members 7 are also adapted to pass through screw eyes 8 in the flexible backrest 9 and support said backrest adjacent to the wall 3 of tank 1. Flaps 10 are secured at one edge 11 to the backrest and at the other edge 12 by means of screw eyes and cords 14 which are adapted to pass through the screw eyes 13 and the apertured extension 6. These flaps provide protection against roughness of lacing members 7. Shoulder straps 15 of conventional design are secured to tank 1 by suitable fastenings such as shown at 16.

Bottom 5 is attached to walls 2 and 3 by a double seam soldered on both the inside and outside. Top 4 is attached to walls 2 and 3 by a single seam soldered on the outside. Apertured extension 6 is five thicknesses of metal, with a double hem and dipped in solder to insure against leaking. Verticle inside struts are provided to give support to the side walls 2 and 3. Tank 1 is made of 26-gage galvanized sheet iron. Flexible backrest 9 is made of 12 ounce duck. Laces 7 are 1/4 inch latigo leather. The capacity of the tank is 5½ gallons.

Operation of the knapsack - One end of a 30 inch length 1/2 inch diameter garden hose is slipped over the tail piece of the Brown pump and clamped in place the other end is attached and clamped to the knapsack spigot. After the knapsack has been filled with liquid, the entire unit is placed on the back of an operator and properly adjusted. Both hands are free to operate the pump. Gravity feeds the chemical into the pump. A fine spray is produced by a moderate action of the plunger. The entire unit weighs approximately 60 lbs., when completely filled and ready for spraying. The entire unit empty weighs 13 lbs.

KNAPSACK

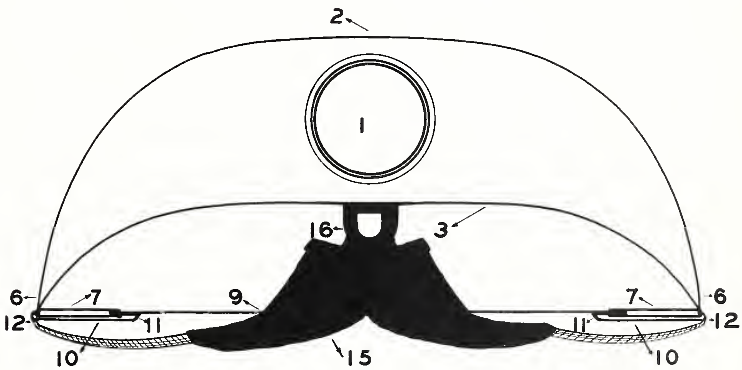


FIG. 4

DRAWN BY John F. Breakey OFFICE OF BLISTER-RUST CONTROL 11-27-29

KNAPSACK

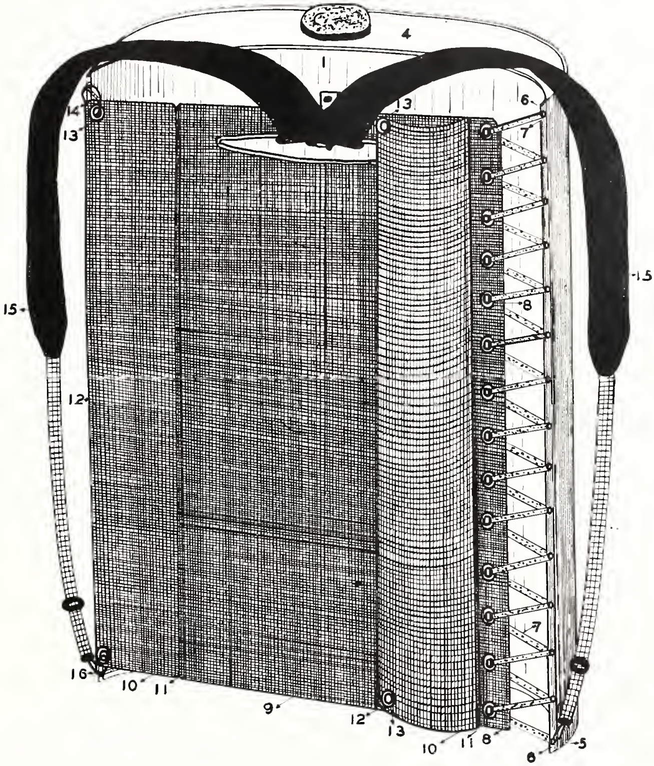


FIG. 5

DRAWN BY John F. Breakey OFFICE OF BLISTER-RUST CONTROL 12-4-29

c. Packboard and tank.

Figures 6 and 7 show a top plan view and a perspective view of the packboard and tank, specifications determined and used during the past field season by the Office of Blister-Rust Control. The revised packframe is manufactured by the owners of the original packboard patents, the Charles Trager Company of Seattle, Washington.

Tank 1 is strapped on packboard 2 by means of leather straps 3 secured by D-ring and screw eye 4 and buckle 5, the upper strap going through strap-eye 6 to keep tank 1 in position. Spring oak bows 11 are morticed and attached with screws to spruce uprights 12. Canvas jacket shown as 7 and 8, outer extremities indicated, laced with cord 9 drawn through eyelets 10. Pack straps 13 are tacked to upper oak bow 11 at 17 and are drawn through canvas jacket 8 at 15, back through at 14 and fastened to a detachable hook at 16. The tank is filled at 18 and the solution is drawn out through spigot 19.

The bottom of the tank is fastened to the sides by a double seam, and soldered on both the inside and outside. The top is attached to sides by a single seam, soldered on the outside. Tank 1 is made of 26-gage galvanized sheet iron. The capacity of the tank is $5\frac{1}{2}$ gallons.

The operation of this unit is the same as that of the knapsack with one exception. This unit is capable of a two-fold use - as a sprayer, and when the tank is removed, as a frame for carrying supplies to inaccessible regions. The entire sprayer, pump, hose, packboard and tank weighs $12\frac{1}{4}$ lbs. when empty. The weight of the unit filled with chemical spray is approximately 60 lbs.

Figures 8, 9, 10, 11 and 12 show details in the assembly of the packboard and tank sprayer, packboard frame 1 indicating the means of attaching straps 3 on top of oak bow 5 at 2 and hooking same at the lower end by slipping square ring 9 over hook 4 on lower bow 7. The morticed joints with screws indicated are shown at 8. Strap adjustment buckles 10 are shown on straps 3. The canvas cover or jacket for packboard 11 has openings for straps at 13 and 14. Grammets or eyelets 12 are adapted for lacing cord when placed on frame 1.

c. Packboard and tank.

Figures 6 and 7 show a top plan view and a cross-sectional view of the packboard and tank, modifications [illegible] made during the past field season by the Office of Blister-Rust Control. The revised packframe is manufactured by the owners of the original packboard patents, the [illegible] Company of Seattle, [illegible].

Tank 1 is [illegible] on packboard 2 by means of [illegible] secured by O-ring and screw eye 4 and buckle 5, the [illegible] going through strap-eye 6 to keep tank 1 in position. Spring [illegible] bows 11 are mortised and attached with screws to [illegible]. Canvas jacket shown as 7 and 8, outer extremities indicated, [illegible] cord 9 drawn through eyelets 10. Pack straps 13 are hooked at upper oak bow 11 at 17 and are drawn through canvas jacket [illegible] back through at 14 and fastened to a detachable hook at 16. The tank is filled at 15 and the solution is drawn out through a [illegible].

The bottom of the tank is fastened to the sides by a [illegible] seam, and soldered on both the inside and outside. The top is fastened to sides by a single seam, soldered on the outside. Tank 1 is made of 26-gauge galvanized sheet iron. The capacity of the tank is [illegible] gallons.

The operation of this unit is the same as that of the [illegible] with one exception. This unit is capable of [illegible] sprayer, and when the tank is removed, [illegible] to inaccessible regions. The entire sprayer, [illegible] tank weighs 10½ lbs. when empty. The weight of the [illegible] chemical spray is approximately 50 lbs.

Figures 8, 9, 10, 11 and 12 show details in the assembly of the packboard and tank sprayer, packboard frame 1 indicating the [illegible] of attaching [illegible] at 3 and locking [illegible] lower end by sliding [illegible] 5 over [illegible] 6 in lower [illegible] 7. The mortised joints with screws indicated are shown at 8. [illegible] buckles 10 are shown on straps 9. The [illegible] cover [illegible] packboard 11 has [illegible] at 14. [illegible] eyelets 12 are adapted for lacing cord when placed in [illegible].

PACKBOARD AND TANK

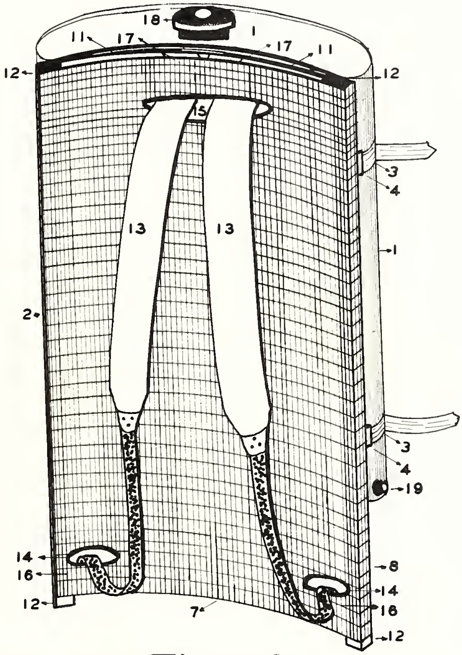


FIG. 6

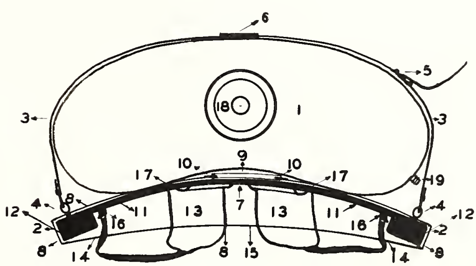


FIG. 7

12-11-29

DRAWN BY John F. Breakey OFFICE OF BLISTER-RUST CONTROL

PACKBOARD AND TANK

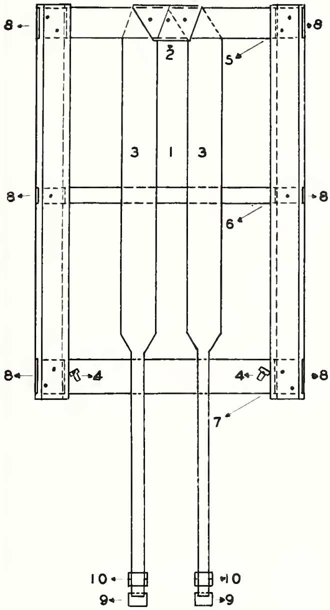


FIG. 8

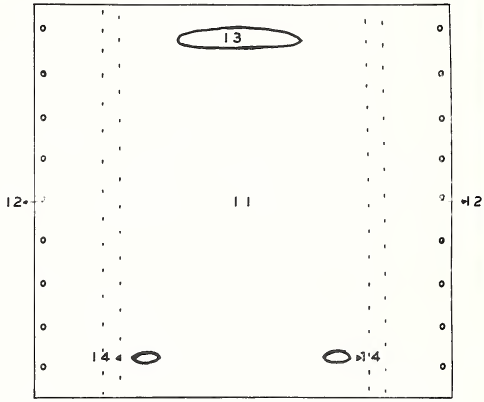
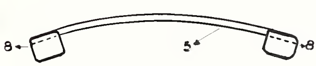
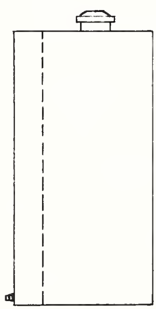


FIG. 9





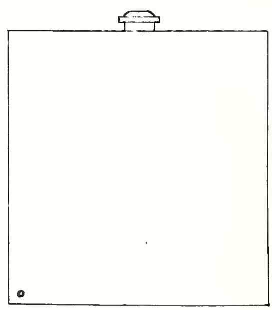


FIG. 10 FIG. 11 FIG. 12

12-18-29

DRAWN BY John F. Buckley OFFICE OF BLISTER-RUST CONTROL

TABLE NO. 2

COST OF MANUFACTURE OF KNAPSACK SPRAYING UNIT

	Cost of Knapsack										
	Tank	Pack-board	Canvas Backrest	Latigoes	Pack-straps	Filling Cap	Outlet Spigot	Leather Straps	Strap Hooks	Total Packboard Unit Cost	Total Knapsack Unit Cost
Improved Knapsack	$2.65		$ .97	$ .30	$.70	$ .32	$ .25		$.34		$ 5.53
Packboard and Tank	$1.95	$3.00				$ .32	$ .25	$ .54		$ 6.06	
	Cost of Pump										
	Brown Pump	2' Length 1/8" Iron Extension	Utility Nozzle No. 80	Extension Tip Repairs	Hose	Washers	Hose Clamp Tool	Hose Clamp Wires	Total Pump Cost		
Pump	$2.85	$ .20	$ .65	$ .50	$.18	$ .04	$.25	$.02	$ 4.69	4.69	4.69
Total cost of assembled spraying unit.										$ 10.75	$ 10.22

These figures are based on lot purchases of perfected field equipment and do not include experimental units built in the development of a suitable sprayer.

Up to this time the Western Office of Blister-Rust Control has purchased 122 Brown pumps, 64 knapsacks, 60 assembled packboards, 73 canvas backrests for knapsacks, 55 tanks for packboards, 144 packstraps, and latigoes, spigots, filling caps, etc., to fully equip same. This equipment was used during the 1929 field season.

Care of equipment - At the close of the field season all sprayers were dissembled, wooden parts were oiled and painted, canvas and leather goods washed and leather oiled, and the metal parts were given a bath in a weak solution of hydrochloric acid to remove oil, chemical spray residue and dirt from both the inside and the outside. The tanks were then painted.

RESULTS OF EXTENSIVE FIELD TESTS

Results of extensive field tests of both knapsack and packboard and tank show the following:

1. Both units have proven satisfactory as sprayers (a few minor faults were determined and changes are indicated in recommendations for 1930 which follow).

2. The packboard has the added advantage of being useful in transporting supplies to regions not easily reached by pack train or auto truck.

RECOMMENDATIONS

I. Use the packboard and tank as manufactured for 1929 field use, but with the following changes:

A. Put an angle iron seat for tank on packboard to hold tank in position.

B. Make a 30 to 35 degree bend in the outlet spigot to avoid hose breaking.

C. Provide the outlet with a shut-off valve.

D. Use short pieces of aluminum flexible tubing to supplement wire housings as they have proven inadequate.

E. Place a diagram of working parts of the pump and directions for upkeep in the hands of each crew foreman.

F. Make the canvas jacket of heavier material doubling the bottom 1/3.

G. Use bolt eyes to secure straps to packframe instead of screw eyes.

H. Have all wooden parts on new equipment oiled and painted before being sent into the field.

I. Provide pack straps of better quality.

II. Experiments to be carried out in testing new types of equipment and their adaptability to our work.

A. Build a 4-gallon tank in order to reduce the load.

B. Determine the kind of sheet metal most resistant to the chemical killing agents we are using, build sample tanks of this and put them in the field for extended tests. (The galvanized iron is attacked to some extent by chemicals.)

C. Plate with copper several of the galvanized iron tanks and put them in field for extended tests.

D. Build tank models of a lighter gage iron than now used with:

1. Struts for side strength.
2. Double seams for added strength.

E. Determine the merits of the grease packing gland for pump.

F. Build sample pack frames of aluminum tubing instead of wood which springs out of shape after continued use in connection with chemicals.

G. Secure all necessary information to assist us in either adapting or building a small portable chemical duster to use in applying chemical killing materials to wild Ribes when chemicals are mixed with a proper hygroscopic agent.

H. Build a new 2-way pump with the needs of our special job paramount.

1. Changes needed to make the pump fit our needs.
    a. Reduce size of pump.
        (1) Greater pressure per square inch per unit of pressure applied.
        (2) Lighter in weight.
        (3) More easily operated.
    b. Faults in old makes removed.
        (1) Reinforced nozzle tip.
        (2) Larger packing gland.
        (3) Larger valve opening.
        (4) Heavier plunger stop rings pinned and soldered.

2. Reasons for building a special pump.

a. All pumps on the market are dual purpose apparatus.
   (1) Used for pumping full stream of water or spray.
   (2) Used for small spraying jobs.
   (3) Used for spraying or washing poultry houses.
   (4) Used for whitewashing.
   (5) Used for fire fighting.

3. All pumps are toolight to stand up under heavy duty for a long period of time.
   a. Remanufacture necessary before being sent into the field.

4. Object in building a new pump.
   a. To reduce the man power necessary to spray a unit.

EXPERIMENTAL STREAM TYPE RE-ERADICATION

By
Harry F. Geil,
Agent.

PURPOSES

1. To determine the number of bushes and feet of live stem missed or not killed per acre in original eradication, and the causes.

2. To determine the number of seedlings and sprouts reproduced per acre following original eradication.

3. To determine the relative cost of chemical and hand re-eradication of Ribes following original eradication with chemicals.

4. To determine the relative effectiveness of the six different spray solutions used on original eradication on this area.

LOCATION AND DESCRIPTION OF AREA

A. Location

The area chosen for this operation was a portion of the East Fork of Potlatch Creek drainage, near Bovill, Idaho and lying within the east half of township 41 north, range 1 east, Boise Meridian.

This area was chosen because it was the only large area of stream type that had been eradicated of Ribes by the chemical method.

B. Description

The area was all stream type varying in width from one to ten chains.

METHODS, EQUIPMENT AND MATERIAL

A. Method

1. The up-stream half of each block was sprayed by the knapsack spraying method and the lower half was hand pulled.

2. A count was made of the different species of seedlings, sprouts and bushes and the time and amount of spray required on each half of each area.

B. Equipment

The regulation knapsack spraying equipment consisting of the improved tank and double-action pump was used.

C. Material

A 10% solution of sodium chlorate plus calcium chloride was used until July 19 and a 10% solution of Atlacide was used for the remainder of the season. A glue spreader, 1/2 pint stock solution to 14 gallons of spray solution was used.

WORK PERFORMED

In addition to the re-eradication of 219.3 acres, a protective strip totaling 113.2 acres was eradicated along the border of the 1928 eradicated area and also 4 acres of methods plots were re-worked, making a total area of 336.5 acres.

Since protection to pine and development of methods were not of major importance on this operation the tables, analyses, etc., following, deal only with re-eradication on the 6 blocks listed below:

Sprays Used in Eradication on the Different Blocks - 1928

Block No.	Spray No.	
II	II	25% $NaClO_3$ and whale oil spreader
IV	IV	20% $NaClO_3$
V	V	20% $NaClO_3$ and whale oil spreader
VI	VI	9.6# $NaClO_3$ + 7.2# $CaCl_2$ + 9½ gallons water and 1 pint whale oil spreader
VII	VII	30% $NaClO_3$ and whale oil spreader
VIII	VIII	20# $NaClO_3$ + 15# $CaCl_2$ + 10 gallons water and 1/2 pint whale oil spreader

TABLE NO. 1.

DISTRIBUTION OF RIBES SEEDLINGS, SPROUTS AND OTHER BUSHES ON THE DIFFERENT BLOCKS.

		Ribes			
Block No.	Acres	Seedlings	Sprouts	Other*	Total
II	40.0	3,560	4,435	2,950	10,945
IV	16.9	235	209	432	876
V	67.6	2,990	2,705	2,424	8,119
VI	28.0	43,647	3,923	11,499	59,071
VII	64.8	3,723	2,987	7,826	14,536
VIII	2.0	64	66	241	371
Total	219.3	54,221	14,325	25,372	93,918

*Other Ribes includes bushes which survived original eradication whether missed or not killed by sprays used.

TABLE NO. 2.

DISTRIBUTION OF RIBES SEEDLINGS, SPROUTS AND OTHER BUSHES ON ALL BLOCKS COMBINED.

Ribes	Totals	Total Per Acre	Per Cent of Total
Seedlings	54,221	247.2	58
Sprouts	14,325	65.3	15
Others	25,372	115.7	27
Totals	93,918	428.2	100

TABLE NO. 3.

NUMBER OF ACRES, RIBES OF EACH SPECIES, MAN-DAYS AND RIBES PER ACRE ON EACH BLOCK.

Block No.	Acres	Man-Days	R. lac.	R. pet.	R. iner.	R. visco.	Totals	Per Acre
II	40.0	35.88	5,914	3,721	1,268	42	10,945	273.6
IV	16.9	11.63	457	391	28	0	876	51.8
V	67.6	45.50	3,877	3,735	507	0	8,119	194.0
VI	28.0	67.50	5,449	49,799	3,823	0	59,071	2,109.6
VII	64.8	57.87	6,310	2,832	5,385	9	14,536	224.2
VIII	2.0	1.62	242	74	55	0	371	185.5
Totals & Averages	219.3	220.00	22,249	60,552	11,066	51	93,918	428.2

TABLE NO. 4.

SPROUTS AND BUSHES FOUND ON DIFFERENT BLOCKS SHOWING RELATIVE EFFECTIVENESS OF VARIOUS SPRAYS USED ON ORIGINAL ERADICATION.

Block No.	Acres	Sprouts*		Others**		Total
		Total	Per Acre	Total	Per Acre	Per Acre
II	40.0	4,435	110.9	2,950	73.7	184.6
IV	16.9	209	12.4	432	25.6	38.0
V	67.6	2,705	40.0	2,424	35.8	75.8
VI	28.0	3,923	140.0	11,499	410.7	550.7
VII	64.8	2,987	46.1	7,826	120.8	166.8
VIII	2.0	66	33.0	241	120.5	153.5
Totals & Averages	219.3	14,325	65.3	25,372	115.7	181.0

*New growth from an old root is called a sprout.

Assuming the Ribes stand on the different areas to have been equal before eradication Table No. 4 clearly shows spray No. IV to be the most effective and spray No. VI the least effective.

TABLE NO. 5.

R. PETIOLARE SPROUTS AND BUSHES FOUND ON DIFFERENT BLOCKS TO SHOW RELATIVE EFFECTIVENESS OF VARIOUS SPRAYS USED ON ORIGINAL ERADICATION ON R.PETIOLARE

Block No.	Acres	Sprouts		** Others		Total
		Total	Per Acre	Total	Per Acre	Per Acre
II	40.0	1,479	36.9	499	12.5	49.4
IV	16.9	134	7.9	96	5.7	13.6
V	67.6	814	12.0	682	10.1	22.3
VI	28.0	3,449	123.2	5,181	185.0	308.2
VII	64.8	182	2.8	840	13.0	15.8
VIII	2.0	6	3.0	49	24.5	27.5
Totals & Averages	219.3	6,064	27.6	7,347	33.5	61.1

**Seedlings not included in Tables 4 and 5 because they germinated since 1928 Ribes eradication was done and have no bearing on the toxic action of sprays used on Ribes bushes in 1928.

Using data on R. petiolare only Table No. 5 gives the same efficiency results as Table No. 4, that is, spray No. IV is the most effective and spray No. VI the least effective.

TABLE NO. 6.

NUMBER OF FEET OF LIVE STEM SURVIVING ON DIFFERENT BLOCKS AND FEET PER ACRE. OLD BUSHES SURVIVING ORIGINAL ERADICATION ONLY.

Block No.	Acres	R. lacustre Total	R. lacustre Per Acre	R. petiolare Total	R. petiolare Per Acre	R. inerme Total	R. inerme Per Acre	Total Feet Live Stem Per Acre
II	40.0	9,556	239	5,226	131	18,778	469	839
IV	16.9	1,406	83	506	30	137	8	121
V	67.6	7,003	104	4,114	61	1,227	18	183
VI	28.0	39,203	1,400	67,742	2,419	44,217	1,579	5,398
VII	64.8	11,096	171	7,165	110	70,292	1,085	1,366
VIII	2.0	848	424	254	127	343	171	722
Totals & Averages	219.3	69,142	315	85,007	387	134,994	615	1,318

Using the number of feet of live stem, Table No. 6 shows the same relative effectiveness as Tables No. 4 and No. 5. Therefore, it is evident that spray No. IV was the most effective of the six used.

DISCUSSION AND ANALYSIS

An analysis of Tables No. 1 and 2 shows that seedlings come in the first year after eradication in great numbers. A total of 58% of all Ribes recorded being seedlings, 27% surviving bushes, and 15% sprouts.

87% of the seedlings were R. petiolare, 11% R. lacustre and 2% R. inerme. The seedlings were distributed quite generally over the area while the sprouts were confined more to the lower ground near the stream,

The reasons for the ineffectiveness of spray No. 6 are stated by H. R. Offord (in charge of chemical investigations being conducted by Western Office of Blister-Rust Control) as follows:

Using data on R. petiolare only Table No. 5 gives the same efficiency results as Table No. 4, that is, spray No. IV is the most effective and spray No. VI the least effective.

TABLE NO. 5.

NUMBER OF FEET OF LIVE STEM SURVIVING ON [illegible] PER ACRE. OLD BUSHES SURVIVING [illegible] ONLY

		R. lacustre		R. petiolare		R. inerme		Total feet
Block No.	Acres	Total	Per acre	Total	Per acre	Total	Per acre	live stem per acre
II	40.0	5,556	[illegible]	6,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IV	15.5	1,405	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
V	67.6	7,005	[illegible]	4,114	[illegible]	[illegible]	[illegible]	[illegible]
VI	28.0	39,[illegible]	1,400	[illegible]	[illegible]	44,[illegible]	[illegible]	[illegible]
VII	64.8	11,096	171	7,165	[illegible]	[illegible]	[illegible]	[illegible]
VIII	2.0	848	424	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals & Averages	215.3	65,[illegible]42	[illegible]	85,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Using the number of feet of live stem, Table No. 5 shows the same relative effectiveness as Tables No. 4 and No. 5. Therefore, it is evident that spray No. IV was the most effective of the six used.

DISCUSSION AND ANALYSIS

An analysis of Tables No. 1 and 2 shows that seedlings came in the first year after eradication in great numbers. A total of [illegible] of all Ribes recorded being seedlings, [illegible] surviving bushes, and 15% sprouts.

87% of the seedlings were R. petiolare, [illegible] R. lacustre and 2% R. inerme. The seedlings were distributed quite generally over the area while the sprouts were confined more to the lower ground near the stream.

The reasons for the ineffectiveness of spray No. [illegible] [illegible] by [illegible] Offord (in charge of chemical investigations being conducted by Western Office of Blister-Rust Control) as follows:

"For the most part the results confirm our earlier observations regarding the comparative toxicity of sodium chlorate and sodium chlorate plus calcium chloride. It is most likely that the poor results obtained with spray No. VI are due to the following reasons: (1) presence of the hygroscopic agent $CaCl_2$, (2) alkaline solution, the pH of the spray must have been around 10 since it was not properly adjusted, (3) the lateness of the season, (4) combination of the first three undesirable factors with the dilute solution. I would, of course, expect best results from No. IV which contained sodium chlorate alone at about the proper pH. If you compare No. VI with No. VIII it is apparent that the amount of $CaCl_2$, since it is inhibitory in its action, is important. No. VI formulae contains more $CaCl_2$ proportionately than does spray No. VIII. Spray No. VIII, of course, contained more sodium chlorate, but aside from that the presence of $CaCl_2$ shows up as an inhibitor.

"Spray No. VI is very close to the mixture that we used before the Atlacide arrived and moreover corresponds rather closely to the proportions of sodium chlorate and calcium chloride in the Atlacide. There is one important difference, however, and that is the pH value of the sprays which we used this past summer are on the right side of the wire and I expect better results. However, when we use the calcium chloride, as I have previously pointed out, we must content ourselves with a lower percentage of kill than we would obtain by using the sodium chlorate alone."

TABLE NO. 7.

DISTRIBUTION OF RIBES SEEDLINGS, SPROUTS AND OTHERS BY SPECIES.

Species	Seedlings		Sprouts		Others	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
R. petiolare	47,141	77.9	6,064	10.0	7,347	12.1
R. lacustre	6,041	27.0	7,051	32.0	9,157	41.0
R. inerme	1,028	9.0	1,195	11.0	8,843	80.0
R. viscosissimum	11	21.5	15	29.5	25	49.0
Totals & Averages	54,221	57.7	14,325	15.3	25,372	27.0

"For the most part the results confirm our earlier observations regarding the comparative toxicity of sodium chlorate and sodium chlorate plus calcium chloride. It is most likely that the poor results obtained with spray No. VI are due to the following reasons: (1) presence of the hygroscopic agent $CaCl_2$, (2) alkaline solution, the pH of the spray must have been around 10 since it was not properly adjusted, (3) the lateness of the season, (4) combination of the first three undesirable factors with the dilute solution. I would, of course, expect best results from No. IV which contained sodium chlorate alone at about the proper pH. If you compare No. VI with No. VIII it is apparent that the amount of $CaCl_2$, since it is inhibitory in its action, is important. No. VI formulae contains more $CaCl_2$ proportionately than does spray No. VIII. Spray No. VIII, of course, contained more sodium chlorate, but aside from that the presence of $CaCl_2$ shows up as inhibitor.

"Spray No. VI is very close to the mixture that we used before the Atlacide arrived and moreover corresponds rather closely to the proportions of sodium chlorate and calcium chloride in the Atlacide. There is one important difference, however, and that is the pH value of the sprays which we used this past summer are on the right side of the wire and I expect better results. However, when we use the calcium chloride, as I have previously pointed out, we must content ourselves with a lower percentage of kill than we would obtain by using the sodium chlorate alone."

TABLE NO. 7.

DISTRIBUTION OF RIBES SEEDLINGS, SPROUTS AND OTHERS BY SPECIES.

Species	Seedlings		Sprouts		Others	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
R. petiolare	47,141	77.5	6,034	10.0	7,397	12.1
R. lacustre	6,441	27.0	7,751	32.[illegible]	9,157	[illegible]
R. inerme	1,023	9.0	1,195	11.0	[illegible]	[illegible]
R. viscosissimum	11	21.6	[illegible]	[illegible]	[illegible]	[illegible]
Totals & Average	54,621	67.7	14,325	15.3	25,[illegible]	17.0

The striking feature of Table No. 7 is the distribution of seedlings. Four-fif ths of all seedlings were R. petiolare with R. inerme falling below R. lacustre. R. inerme is low in reproduction of seedlings and sprouts on the area worked.

TABLE NO. 8.

DISTRIBUTION OF RIBES SEEDLINGS, SPROUTS AND OTHERS BY BLOCKS.

Block No.	Seedlings		Sprouts		Others	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
II	3,560	32.5	4,435	40.5	2,950	27.0
IV	235	26.8	209	23.9	432	49.3
V	2,990	36.8	2,705	33.4	2,424	29.8
VI	43,649	73.9	3,923	6.6	11,449	19.5
VII	3,723	25.7	2,987	20.5	7,826	53.8
VIII	64	17.3	66	17.8	241	64.9
Totals	54,221	-	14,325	-	25,372	-

Block No. VI upon which eradication efficiency was lowest, shows the greatest reproduction of seedlings.

STATEMENT AND ANALYSIS OF COSTS.

TABLE NO. 9.

DISTRIBUTION OF COSTS.

I t e m	Cost	Per Cent
Salaries	$1,712.62	58.6
Subsistence	752.82	25.6
Equipment	118.16	4.5
Chemical	138.14	4.6
Transportation of men	123.15	4.2
Miscellaneous	76.94	2.5
Totals	$2,921.83	100.0

TABLE NO. 10.

COST OF RE-ERADICATION ONLY.

P r o j e c t	Acres	Total Cost	Cost Per Acre	Man-Days	Cost Per Man-Day
Re-eradication	219.3	$1,690.42	$7.72	220	$7.68

TABLE NO. 11.

COMPARATIVE COST OF HAND AND CHEMICAL RE-ERADICATION

Method	Acres	Man-Days	Cost Excluding Chemical and Spray Equipment	Cost of Spray Equipment and Chemical	Total Cost	Per Acre
Hand	123.7	115.62	$ 809.37		$ 809.37	$6.54
Chemical	95.6	104.38	730.63	$150.42	881.05	9.22
Totals & Averages	219.3	220.00	$1,540.00	$150.42	$1,690.42	$7.71

The above table shows that it cost less to re-eradicate by hand than by chemicals.

The difference between the cost as shown by Tables No. 9 and 10, $1,231.41, is accounted for by the fact that Table No. 10 is for re-eradication only while Table No. 9 includes the cost of extra eradication, of working methods plots and the salary and expenses of one man for recorder. On a practical job this recorder would not be used, hence his cost was not included against the job.

SUMMARY

An analysis of all tables leads to the conclusion that Ribes seedlings come in after chemical eradication in great profusion.

In the reproduction of Ribes seedlings, R. petiolare is first, R. lacustre second and R. inerme third.

In the reproduction of sprouts, R. lacustre is first, R. petiolare second and R. inerme third.

Of the sprays used on eradication No. IV was the most effective. The cost per acre for re-eradication was less by hand than by chemicals.

RE-ERADICATION OF RIBES BY HAND-PULLING METHODS, IDAHO, 1929

Field Supervision by C. O. Peterson
Report by C. C. Strong

INTRODUCTION

In 1928 re-eradication was conducted on an area where fewer Ribes bushes per acre were found by original eradication crews than for any other area worked during the period 1924-1929. For this reason the results obtained could be only locally applied. In order to secure information which might be applied to those regions having a high original Ribes population the decision was made to conduct the 1929 experiments on the area drained by the Little North Fork of the Coeur d'Alene River centering around Honeysuckle Ranger Station on the Coeur d'Alene National Forest. A large part of the area was originally eradicated of Ribes in 1927. The background for re-eradication experiments is set forth in the "1928 Annual Report of the Western Office" and will not be repeated here.

PURPOSES OF EXPERIMENT

1. To determine the average cost per acre for first re-eradication of Ribes in various eradication types.

2. To determine, on a large scale, the approximate protection afforded an area in terms of amount of Ribes left, the species, location of bushes and extent and character of Ribes reproduction following original eradication.

3. To determine what eradication types are adequately protected by one eradication of Ribes.

4. To determine the growth and survival of the numerous Ribes which germinate along chutes and skidways for varying periods following logging.

AREA ON WHICH WORK WAS DONE

Any one of the five camp areas worked in 1927, with the exception of the Cascade Creek drainage where no cut-over land was included, was satisfactory for re-eradication purposes. Hence,

the most accessible one, Skookum Creek, was chosen. Another reason for choosing this area was that one block of the Sand Creek area could be reached conveniently from the camp site selected. Furthermore a 1917 cutting which was not eradicated of Ribes, adjoined the Skookum Creek area and it was possible to secure from it considerable information regarding the Ribes growth and survival along the chutes and skidways.

METHODS OF WORKING

Crew methods employed were according to the best standards previously developed for the varying conditions encountered. Blocks as originally worked in 1927 were re-worked. Comparative data are shown under results.

Two special studies were made; (1) to determine the feasibility of spraying heavy concentrations of *Ribes inerme* so prevalent along the Little North Fork of the Coeur d'Alene River, and (2) to determine the feasibility of spraying *R. viscosissimum* and *R. lacustre* seedlings where they exist in such profusion as to make hand pulling impractical.

The re-eradication unit consisted of 14 men including the field supervisor.

RESULTS OF WORK

Hand Eradication.

Four blocks in the Skookum Creek area and one block in the Sand Creek area which were completely covered in 1927 were re-eradicated of Ribes in 1929. Table No. 1 shows the results of work done on these blocks. It will be noted that data are shown on a comparative basis, the 1927 results being contrasted with those of 1929.

TABLE NO. 1

COMPARATIVE RESULTS OF RIBES ERADICATION IN 1927 AND RIBES RE-ERADICATION IN 1929

Eradication Type	Acres	Ribes Pulled Re-eradication 1929					Ribes Pulled 1927		Live Stem Per Acre		Man-Days		Cost Per Acre	
		Seed-lings	Sprouts	Others	Total Number	Total Per Acre	Total Number	No. Per Acre	1929	1927	1929	1927	1929	1927
Stream	193.7	7,995	1,094	3,946	13,035	67.3	109,929	567.5	123	11,350	88.22	465.55	$2.71	$14.53
D.M.	146.5	9	10	22	41	0.3	1,486	10.1	2	212	5.42	12.42	.23	.52
O.M.	1,632.2	6,136	376	2,340	8,852	5.4	76,864	48.3	47	676	92.23	341.45	.34	1.24
D.P.	445.5	1,198	133	409	1,740	3.9	29,912	67.1	12	872	29.47	59.95	.40	.81
O.P.	153.9	1,468	6	52	1,526	9.9	11,936	77.6	3	388	12.43	43.34	.48	1.67
D.R.	494.0	20	17	67	104	0.2	10,844	22.0	59	330	8.62	103.50	.11	1.33
O.R.	80.0	1,014	47	691	1,752	21.9	12,639	158.0	43	1,738	20.55	81.91	1.55	6.11
C.O.	1,554.0	171,540	854	6,909	179,303	115.4	621,822	400.1	43	3,200	205.56	801.38	.78	2.93
All	4,699.8	189,380	2,537	14,436	206,353	43.9	875,432	186.3	46	2,794	462.60	1,909.50	$ .59	$ 2.41

Of the total number of Ribes pulled in 1929 by re-eradication crews 92% were seedlings, 1% were sprouts and 7% were bushes missed by original eradication crews in 1927.

In addition to the re-eradication work done as shown in Table No. 1 certain areas adjoining not worked in 1927 were completed in 1929. The results of this original Ribes eradication are shown in Table No. 2.

TABLE NO. 2

ORIGINAL ERADICATION DONE IN 1929

Eradication Type	Acres	Number Ribes Pulled R. lac.	R. vis.	R. iner.	Per Acre	Live Stem Total	Per Acre	Man-days Total	Per Acre	Cost Per Acre
Stream	4.6	484	1	153	139	10,572	2,300	5.5	1.20	$7.82
C.C.	46.0	540	12,691		288	625	14	5.5	.12	.78
C.M.	100.0	4,615	52		47	220,852	2,209	50.1	.50	3.26
C.P.	43.0	499	38		12	52,168	1,199	3.5	.08	.53
Average					99		1,470		.33	$2.17
or Total	193.6	6,138	12,782	153		284,217		64.6		

Studies of the growth and survival of Ribes along chutes and skidways were confined to two areas on which logging took place in 1917 and 1926 respectively. The areas chosen were fairly representative respectively of other areas having been logged for the same periods as determined by experience and numerous examinations of logged over areas in the general region. Table No. 3 shows the results of two studies made.

TABLE NO. 3

RESULTS OF ERADICATING RIBES ALONG CHUTES AND SKIDWAYS

Year of Logging	Acres Worked	Ribes Pulled Number	Per Acre	L. S. Destroyed Total Feet	Feet Per Acre	Average Size Bushes Pulled	Man-days Total	Per Acre
1917	9	5,280	587	87,205	9,690	16.5	15.75	1.75
1926	4	3,057	764	255	64	.1	3.43	.86

Logical deductions to be made from the experiment are as follows:

1. Although germination of Ribes seeds on the 1926 cut-over area had apparently ceased (no bushes were found of 1929 germination) most of the bushes having germinated in 1928 and some of those having germinated earlier were so small that too many are missed. Eradication the fourth year following logging and brush disposal would no doubt be feasible.

2. Amount of Ribes live stem per acre is so small that eradication could be delayed to the fourth or fifth year without danger of great volumes of sporidia being produced on the leaves of Ribes seedlings.

3. Although there were fewer Ribes per acre on a twelve year cutting the bushes were of such size and difficulty of working so great that the average cost of working per acre was much greater than on the three-year cutting. Hence twelve years is far too long to wait both from the standpoint of cost of eradication of Ribes and from the standpoint of potential production of sporidia on the blister rust infected Ribes leaves.

Chemical Eradication.

In 1927 an area of approximately 20 acres where R. inerme existed in such profusion as to make hand pulling impractical was encountered. At that time it was found that eradication of those bushes would necessitate completely clearing the land so intertwined were the R. inerme roots with the roots of alders, willows and other species of the heavy brush cover. Hence it was decided to wait until a spray had been found or developed which would satisfactorily kill R. inerme.

Due to the extensive distribution of blister rust as found in the fall of 1928 it was decided to spray the R. inerme concentrations in 1929 with the sodium chlorate and "Atlacide" sprays chiefly to reduce the R. inerme live stem as much as possible and also as a further check upon the effectiveness of these sprays on the species in question. Table No. 4 shows the results of spraying:

logical deductions to be made from the experiment, are as follows:

1. Although germination of Ribes seeds on the 1925 cut-over area had apparently ceased (no bushes were found of 1928 germination) most of the bushes having germinated in 1926 and some of those having germinated earlier were so small that numerous got missed, eradication the fourth year following logging the area would no doubt be feasible.

2. Amount of Ribes live stem per acre is so small that eradication could be delayed to the fourth or fifth year without danger of great volumes of sporidia being produced on the leaves of Ribes seedlings.

3. Although there were fewer Ribes per acre on the twelve-year cutting the bushes were of such size and difficulty of pulling so great that the average cost of working per acre was much greater than on the three-year cutting. Hence twelve years is far too long to wait both from the standpoint of cost of eradication of Ribes and from the standpoint of potential production of sporidia on the blister rust infected Ribes leaves.

Chemical eradication.

In 1927 an area of approximately 20 acres where R. inerme existed in such profusion as to make hand pulling impracticable was encountered. At that time it was found that eradication of these bushes would necessitate completely clearing the land so intertwined were the R. inerme roots with the roots of alders, willows and other species of the heavy brush cover. Hence it was decided to wait until a spray had been found or developed which would satisfactorily kill R. inerme.

Due to the extensive distribution of blister rust at cover in the fall of 1928 it was decided to spray the R. inerme concentrations in 1929 with the sodium chlorate and "atlacide" sprays in order to reduce the R. inerme live stem as much as possible and also as a further check upon the effectiveness of these sprays on the species in question. Table No. 4 shows the results of operation:

TABLE NO. 4

RESULTS OF SPRAYING R. INERME CONCENTRATIONS IN JULY AND AUGUST, 1929

Eradication Type	Acres	Spray Used: Number Gallons	Spray Used: Gallons Per Acre	Man-days: Total	Man-days: Per Acre
L	5.33	114	21	5.36	1.00
M	13.50	654	48	20.66	1.53
H	1.60	239	149	5.50	3.44
Combined	20.43	1,007	49	31.52	1.54

The effectiveness of the above spraying can not be determined, of course, until the 1930 field season.

A small patch of R. viscosissimum bushes on a logged over area was sprayed to determine the feasibility of spraying heavy concentrations of R. viscosissimum seedlings which frequently come in along chutes and skidways. The effectiveness of this method of eradication can also be determined in the 1930 field season.

COST OF OPERATION

The field cost of conducting studies and experiments done by the re-eradication project on the Coeur d'Alene National Forest are shown in Table No. 5.

TABLE NO. 5

COST OF OPERATION

Item		Cost
Salaries	Supervisors	$1,116.66
	Temporary Employees	2,070.93
Subsistence	Salaries of Cooks	368.50
	Food Used	927.11
	Transportation of food	220.00
General Equipment	Depreciation	224.72
	Transportation	84.58
Spraying equipment	Depreciation	8.07
Miscellaneous	Supplies	39.12
	Expenses	33.91
	Repairs	19.92
	Twine	60.12
Chemical	Chemical Used	81.25
	Transportation	11.93
Transportation Men		158.91
Total		$5,425.73

The supervisors' salaries item includes salary of the field supervisor for 6 months plus the salary of the general supervisor for a proportionate share of this period.

SUMMARY OF RE-ERADICATION BY HAND-PULLING METHODS 1928 AND 1929

Due to the smallness of many of the seedlings pulled by re-eradication crews in 1928 and 1929 it seems definitely settled that re-eradication only two years following original eradication of Ribes by hand-pulling methods is too soon to conduct this type of work. It is therefore recommended that re-eradication be delayed to the third year or even the fourth year unless other factors of consideration make a four year delay inadvisable.

Data secured by the operation on the Kaniksu National Forest in 1928 and the one on the Coeur d'Alene National Forest in 1929 give a fair average basis for forecasting the cost of re-eradication in the future. Table No. 6 shows the averages for the two years work.

TABLE NO. 6

RESULTS RIBES RE-ERADICATION 1928 AND 1929

Eradication Type	Acres Worked			Ribes Per Acre Pulled			Man-days Per Acre			Cost Per Acre		
	1928	1929	Total	1928	1929	Average	1928	1929	Average	1928	1929	Average
Stream	92.0	193.7	285.7	187.4	67.3	106.0	.83	.45	.58	$6.49	$2.71	$ 3.93
D.M.	36.0	146.5	182.5	.1	.3	.2	.04	.04	.04	.31	.23	.26
O.M.	399.0	1,632.2	2,031.2	3.5	5.4	5.0	.06	.06	.06	.47	.34	.37
D.P.	339.9	445.5	785.4	2.1	3.9	3.1	.06	.07	.07	.51	.40	.45
O.P.	1,591.2	153.9	1,745.1	9.2	9.9	9.2	.12	.08	.12	.93	.48	.89
D.R.	180.1	494.0	674.1	4.3	.2	1.3	.14	.02	.04	.83	.11	.30
O.R.	186.0	80.0	266.0	4.2	21.9	9.5	.04	.26	.10	.28	1.55	.66
C.O.		1,554.0	1,554.0		115.4	115.4		.13	.13	.10	.78	.78
All	2,824.2	4,699.8	7,524.0	12.6	43.9	32.2	.12	.10	.11	$0.94	$0.59	$0.72

EXPERIMENTAL APPLICATION OF RIBICIDES

By
C. C. Strong, Associate Forester
W. G. Guernsey, Junior Forester
H. R. Offord, Agent

INTRODUCTION

For several years chemical investigations have been conducted by the Western Office of Blister Rust Control for the express purpose of determining which chemical mixture or solution gives the greatest promise of becoming an effective Ribicide. Ribicide is here and hereafter used to designate any chemical agent destructive to Ribes. During the progress of this investigative work in the past certain chemical sprays were developed but two factors limiting their use were encountered. These factors are (1) high cost of basic chemicals involved and (2) failure of the sprays developed to bring about a satisfactory killing action on currant and gooseberry species other than Ribes petiolare. With the first factor in mind the men engaged upon chemical investigations had investigated the mechanism of the toxic action of sodium chlorate and subsequently recommended using dilute chlorate sprays in slightly acid solution for the eradication of R. petiolare. Research work on the matter of a suitable Ribicide for R. lacustre and R. inerme, moreover, had resulted by the spring of 1929 in development of certain other sprays. The exigencies of stream type eradication called for a large scale field test of the new sprays.

Observations (many of them contradictory in nature) have been made by various investigators concerning the most favorable time of the year for applying chlorate sprays. In the course of experimental chemical eradication of Ribes it had been observed that early season application in the case of R. inerme and R. lacustre gave a higher percentage of kill than late season application of the same spray. R. petiolare seemed to be quite susceptible up to a certain time rather late in the growing season. The proposed reduction in concentration of field sprays necessitated more accurate information concerning the seasonal effect on the toxicity of field sprays to Ribes. Furthermore, the addition of the hygroscopic agent calcium chloride appeared to make the sodium chlorate somewhat less toxic and in view of the proposed reduction in concentration for general field work more complete data on this point was considered desirable.

In addition to the experiments with sodium chlorate, tests were to be made of a copper complex (copper cyanide tetrasodiumthiosulphate) which had been devised in the course of the investigative work at Berkeley. This compound showed such promising results on R. inerme and R. lacustre in the greenhouse tests that a large scale field test of the compound appeared to be necessary in order to determine its suitability for general field use.

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A suitable area for a large scale experiment was located at Clarkia, Idaho, where R. petiolare, R. lacustre and R. inerme occurred in such numbers and distributed in such a manner that it was possible to lay out half-acre plots containing all three. A series of chlorate and copper complex sprays were applied to consecutive half-acre plots on a 14-day rotation from June to September. Certain other investigations of minor importance were conducted. These will be noted under purposes and results.

It is proposed also to use the results of these large scale field experiments as a practical field basis for the correlation of laboratory research such as the analysis of Ribes stems, roots and leaves for starch which is being undertaken at the present time at the University of Idaho.

PURPOSES

1. To test the effectiveness, under actual field conditions, of any spray that had shown promise as a Ribicide in laboratory experiments.

2. To determine the relationship between time of application during the day and degree of effectiveness of any given spray.

3. To determine seasonal effect on the toxicity of chemical to Ribes and the modifications of that seasonal effect caused by:

   a. Concentration of spray.
   b. pH value of spray.
   c. Presence of different hygroscopic agents.

4. To compare effectiveness of refuse molasses and glycerine as a sticker and binder of the new complex sprays.

5. To try out fireproofing materials for clothing used in chemical application.

LOCATION AND DESCRIPTION OF AREA

It was believed by those who selected the area for field tests of sprays that the most ideal area is one on which there is a goodly representation of R. petiolare, R. lacustre and R. inerme. The three species noted are the main stream type Ribes species occurring in the Inland Empire. The relative effectiveness of sprays on the Ribes species could be far more accurately obtained if each plot had each of the three species well represented.

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W.732-Man engaged in spraying _Ribes petiolare_ on his respective strip.

[illegible] illing knapsack spray tank at mixing [illegible] iminary to spraying.

After an exhaustive search an area was selected. This area constitutes a part of the Merry Creek drainage lying within townships 42 and 43 north, range 2 east, Boise Meridian. Merry Creek flows into the Middle Fork of the St. Maries River about one mile east of Clarkia, Idaho. Before the final selection of the area was made it was necessary to secure the permission of all owners whose property would be involved. No serious opposition was encountered in securing the necessary cooperation of owners and in the end full consent of all was obtained.

It is very doubtful if any area could have been found in North Idaho where conditions more nearly approached the ideal set up as a guide when the search for an area began. In fact, of the 141 plots sprayed 129 had all three species in large quantities. All plots had R. petiolare, only three plots did not have R. lacustre and only twelve did not have R. inerme bushes. Furthermore, there were probably more feet of Ribes live stem present on this area before spraying began than on any other equal area in North Idaho. The illustration on the preceding page gives some idea of the mass of brush and Ribes occurring on the Merry Creek area.

Merry Creek drains a rather extensive area which supports an excellent stand of white pine of all age classes. Near the plots, however, the stand is largely of about 40-year age class.

METHODS, EQUIPMENT AND MATERIALS

Plots. Each plot had an area of one-half acre and was rectangular in shape with sides laid out in cardinal directions. Plots were marked with a substantial cedar post at each corner and the necessary numbers and symbols indicated with durable paints. Plot locations are shown on the map at the end of this report.

1. Plot sections. Each plot was divided into three sections. The purpose of this was to facilitate having one section sprayed during the early part of the day, the second during the middle and the third during the latter part of the day. The purpose was to determine whether or not time of applying spray during the day had any influence on effectiveness.

2. Ribes occurrence. Under conditions as severe as those encountered on the Clarkia plots an accurate estimate of Ribes live stem was very difficult to make. However, great effort was expended to make this estimate as accurate as possible. Not only was live stem for each plot recorded by Ribes species but the same information was obtained for each section of each plot. The relative effectiveness of the various sprays used will largely be determined by the per cent of live stem killed on

each plot by species. No good purpose can be served by including in this report the live stem for each plot. However, a sample form on which plot data were recorded is shown at the end. The average feet of live stem per species for each plot was as follows:

(1) R. petiolare = 24,562
(2) R. lacustre = 6,351
(3) R. inerme = 11,263

Methods of Spraying. All spraying was done with knapsack sprayers elsewhere described. Methods of spraying were quite similar to those already described differing only in that the one-half-acre plots were individual blocks on this operation.

Materials Used. In all, 41 different spray solutions were used. Some of these differed only in pH value. The formulae of the sprays used in experimental work are shown in Table No. 1 and include concentration of chemical, pH value of solution and spreader used. pH value may be defined as the log of the reciprocal of the hydrogen ion concentration of a solution. For pure water this value is 7. A solution having a pH value of 7 therefore is considered neutral. Scientific nomenclature has designated as alkaline a solution whose pH is numerically greater than 7 and an acid solution as one having a numerical value less than 7.

There are several factors which influence the pH value of a solution when a certain chemical is dissolved in water. Changes in the acidity of the water supply and a variation of acid or alkali-forming impurities in the chemicals are the most important factors encountered in field practice. If a certain pH value is required it is usually necessary to adjust the pH by means of suitable chemical reagents. This is done most readily under field conditions by adding a small amount of dilute acid (e.g. hygrochloric) or dilute alkali (e.g. sodium hydroxide) to the spray solution. The addition of acid decreases the pH value numerically while the addition of alkali increases it. Fine adjustment is obtained by adding a few drops of an indicator mixture (methyl red plus brom thymol blue) to a few cc's of the solution to be tested and comparing the color so obtained with a standard color chart. Identical spray formulae differing only in pH value of the spray were used in these experiments to determine to what extent the pH value of solution influences the effectiveness of the spray.

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(1) [illegible] = [illegible]
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Results of Work in Field

Sprays Used. The Following table shows plots sprayed with each spray:

TABLE NO. 1

SPRAYS USED AND PLOTS SPRAYED WITH EACH

Plot No.	Spray Solution Applied
1-23-43-62-77	$NaClO_3$ .89# per gal. pH 6.5 + Glue (2)
2-24	$NaClO_3$ 2.7# per gal. pH 6.5
3-25-45-64-79	$NaClO_3$ .89# per gal. + $CaCl_2$ .47# pH 6.5
4-26	$NaClO_3$ 2.7# per gal. + $CaCl_2$ 1.4# pH 6.5
5-27-47-66-81	$NaClO_3$ .89# per gal. + $MgCl_2$ .84# pH 6.5
6-28	$NaClO_3$ 2.7# per gal. + $MgCl_2$ 2.58# pH 6.5
7-29-48-82-91	Cu Complex 2.65# per gal. pH 6.5 + Molasses (3)
8-30-49-83	Cu Complex 3.13# per gal. pH 6.5 + Molasses
9-31-50-84	Cu Complex 1.03# per gal. pH 6.5 + Molasses
10-32-51-85	Cu Complex 2.06# per gal. pH 6.5 + Molasses
11(1)-33(1)-52(1)-67(1)-86(1)	$NaClO_3$ .45# per gal. pH 8
11-33-52-67-86	$NaClO_3$ .89# per gal. pH 8
12-34	$NaClO_3$ 2.7# per gal. pH 8
13-35-54-69-88	$NaClO_3$ .89# per gal. + $CaCl_2$ .47# per gal. pH 8
13(1)-35(1)-54(1)-69(1)-88(1)	$NaClO_3$ .45# per gal. + $CaCl_2$ .23# per gal. pH 8
14-36	$NaClO_3$ 2.7# per gal. + $CaCl_2$ 1.4# per gal. pH 8
15-37-56-71-90	$NaClO_3$ .89# per gal. + $MgCl_2$ .84# per gal. pH 8
15(1)-56(1)-71(1)-90(1)	$NaClO_3$ .45# per gal. + $MgCl_2$ .42# per gal. pH 8
16	$NaClO_3$ 2.7# per gal. + $MgCl_2$ 2.58# per gal. pH 8
17-38-57-72-95	$NaClO_3$ .89# per gal. pH 4
17(1)-38(1)-57(1)-72(1)-95(1)	$NaClO_3$ .45# per gal. pH 4
18	$NaClO_3$ 2.7# per gal. pH 4
19(1)-40(1)-59(1)-74(1)-97(1)	$NaClO_3$ .45# per gal. + $CaCl_2$ .23# per gal. pH 4
19-40-59-74-97	$NaClO_3$ .89# per gal. + $CaCl_2$ .47# per gal. pH 4
20	$NaClO_3$ 2.7# per gal. + $CaCl_2$ 1.4# per gal. pH 4
21(1)-42(1)-61(1)-76(1)-99(1)	$NaClO_3$ .45# per gal. + $MgCl_2$ .42# per gal. pH 4
21-42-61-76-99	$NaClO_3$ .89# per gal. + $MgCl_2$ .84# per gal. pH 4
22	$NaClO_3$ 2.7# per gal. + $MgCl_2$ 2.58# per gal. pH 4
23(1)-43(1)-62(1)-77(1)	$NaClO_3$ .45# per gal. pH 6.5
25(1)-45(1)-64(1)-79(1)	$NaClO_3$ .45# per gal. + $CaCl_2$ .23# per gal. pH 6.5
27(1)-47(1)-66(1)-81(1)	$NaClO_3$ .45# per gal. + $MgCl_2$ .42# per gal. pH 6.5
37(1)	$NaClO_3$ .45# per gal. + $MgCl_2$ .23# per gal. pH 8
39-58-73-96	Atlacide .68# per gal. pH 4
41-60-75-98	Atlacide 1.36# per gal. pH 4
44-63-78	Atlacide .68# per gal. pH 6.5
46-65-80	Atlacide 1.36# per gal. pH 6.5
53-68-87	Atlacide .68# per gal. pH 8
55-70-89	Atlacide 1.36# per gal. pH 8
93	Cu Complex 1.03# per gal. + Glycerine (4)
92	Cu Complex 3.13# per gal. + Glycerine
94	Cu Complex 2.06# per gal. + Glycerine

(1) Plots sprayed with a series of solutions added after original schedule was made up.
(2) Glue (.01% of the dry weight of chemical) was added to all chlorate sprays including Atlacide as a sticker and spreader.
(3) Molasses 1% to 3% by volume was used as indicated with copper complex sprays as a binder. The low grade molasses did not prove satisfactory as a sticker and spreader because of the resultant excessive gumming and clogging of pumps and nozzles.
(4) Glycerine 1% to 3% by volume was used as indicated with copper complex sprays as a binder.

Annual Report, 1929
C. C. Strong

Observations of Sprayed Plots. Late season observations of the toxic action of dilute solutions of sodium chlorate indicated that alkaline solutions of sodium chlorate were less effective than the acid solutions on R. petiolare. The strongest concentration of chlorate to which magnesium chloride had been added as a hygroscopic agent gave indications of being considerably more toxic to R. inerme and R. lacustre than sodium chlorate-calcium chloride mixtures. Unfortunately the magnesium chloride mixtures appeared to be rather dangerous fire hazards and application of the strong solution was discontinued about the middle of July.

Copper complex sprays, the new Ribicide, appeared to be relatively ineffective on R. petiolare as greenhouse tests had previously shown. R. inerme and R. lacustre were much more susceptible than R. petiolare to the action of the copper sprays but did not react as satisfactorily as greehhouse plants. Sun forms of both R. lacustre and R. inerme were much more susceptible than the shade forms. It was also observed that glycerine when used as a binder was much more effective than the refuse molasses and in the former case the killing action of the copper complex was much more characteristic of the type of action secured at Berkeley. However, it is feared that the lateness of the season will militate somewhat against the toxic action of the glycerine-copper complex sprays.

The entire season's work at Clarkia was free from accidents resulting from the combustion of chlorate-soaked clothing and can be attributed in part to a process of fireproofing pants worn by the crewmen and in part to the careful supervision and enforcement of camp rules about keeping clothes washed and somewhat damp while on the job.

The Cost of the Operation. The following table shows the cost of the operation in detail:

Observations of Current Season [illegible]. Late season observations [illegible] the toxic action of dilute solutions of sodium chlorate indicate [illegible] alkaline solutions of sodium chlorate were less effective than [illegible] acid solutions on R. petiolare. The strongest concentration of chlorate to which magnesium chloride had been added as a hygroscopic agent gave indications of being considerably more toxic on R. inerme and R. lacustre than sodium chlorate-calcium chloride mixtures. Unfortunately the magnesium chloride mixture appeared to be rather dangerous fire hazard and application of the strongest mixture was discontinued about the middle of July.

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The entire season's work of [illegible] was free [illegible] resulting from the combustion of chlorate-soaked clothing. This is attributed in part to a process of [illegible] by the men and in part to the careful supervision and enforcement of the rules about keeping clothes washed [illegible].

The Cost of the Operation. The following table shows the cost of the operation in detail:

TABLE NO. 2.

Item		Cost
Salaries	Supervisors	$ 483.33
	Temporary men	1,058.48
Subsistence		410.90
General equipment	Cost	114.61
	Transportation	43.81
Spraying	Equipment	50.59
	Supplies	39.59
Miscellaneous	Expenses	379.72
	Repairs	7.63
	Twine	32.80
Chemical	Cost	833.30
	Transportation	45.48
Transportation of men		170.53
Total		$3,670.77

Precautions Taken to Insure Protection of Crewmen from Possible Chlorate Burns. The fireproofing method used has been previously reported by H. R. Offord. One great difficulty encountered in using the measure was excessive shrinking of materials treated, i.e. pants. Especially was this true of the large scale operations where the larger men were forced to hand their pants down to the small men and buy new ones. Approximately 50 per cent of the men employed on chemical application work in all camps did not have clothing fireproofed. However, all men who came in contact with the chemical used extreme precaution in the matter of washing clothes, etc. The result was that of the 150 men having to do with chemical eradication during the summer, none had any mishap from fire caused by friction against dry clothing which had been saturated with chemical.

FUTURE WORK

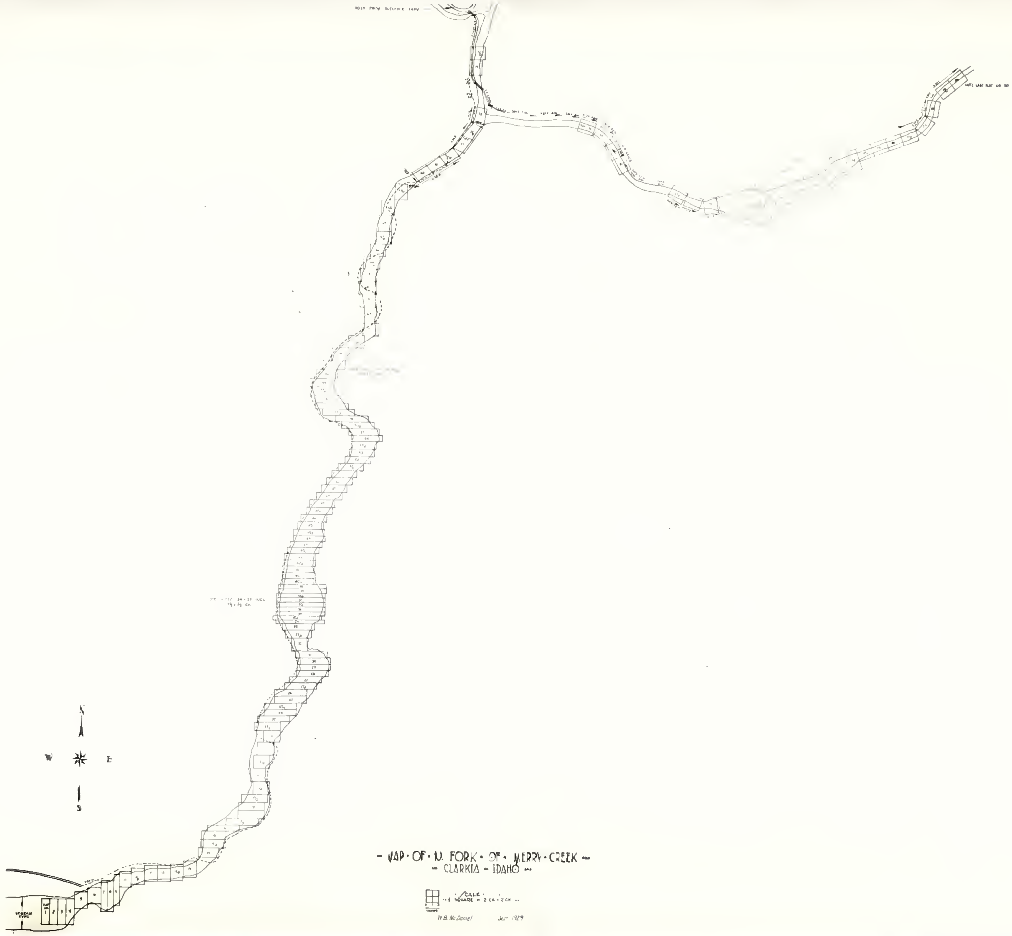
The checking of the plot sprayed in 1930 and probably 1931 (as a final verification) will determine the relative effectiveness of the various sprays used. Checking will be started as early in the summer of 1930 as the vitality of bushes can be determined.

SAMPLE FORM-WF-BRC-#50-6/1/29

APPLICATION OF CHEMICALS - 1929

Area Merry Creek Report by F. A. Walters
Plot No. 3 Location Merry Creek, Clarkia, Idaho
Date Sprayed 12/6/29 Chemical Used $NaClO_3$ .89# + $CaCl_2$ .47#, 1 Gal. Water
pH 6.5

Section	No. 1		No. 2		No. 3		Total	
Length	4 chains		4 chains		4 chains		4 chains	
Width	27.5 links		27.5 links		27.5 links		1½ chains	
Time	8:30 a.m. 10:30 a.m.		10:30 a.m. 1:40 p.m.		1:40 p.m. 3:30 p.m.		7 hours	
Gals. Chem.	8½		10		16		34½	
Ribes Conditions	Feet L. S.	Concen-trations	Feet L. S.	Concen-trations	Feet L. S.	Concen-trations	Feet L. S.	Concen-trations
R. pet.	6,300	12%	800	2%	1,600	5%	8,700	7%
R. lac.	300	1%	200	1%	200	1%	700	1%
R. inerme	800	2%	1,200	4%	2,000	8%	4,000	5%



- MAP · OF · N. FORK · OF · MERRY · CREEK -
- CLARKIA - IDAHO -
· SCALE ·
· 1 SQUARE = 2 CH · 2 CH ·
W.B. McDaniel
Sept 1929
N
W
E
S
STREAM TYPE

PRE-ERADICATION SURVEY ON PRIVATE AND FEDERAL WHITE PINE LANDS

By
W. G. Guernsey,
Junior Forester.

INTRODUCTION

Pre-eradication has come to be a recognized step in the Ribes eradication program. Information secured on such work, since pre-eradication was inaugurated two years ago, has proven invaluable in planning local control of blister rust. Full benefit from pre-eradication was realized during the field season just closed wherever Ribes eradication was done on a pre-eradicated area. On the contrary certain rather serious handicaps developed where it was necessary to carry on Ribes eradication on areas not pre-eradicated. As a result of the 1929 experience regarding the benefits derived from pre-eradication a decision was made to conduct pre-eradication on all areas to be eradicated of Ribes in the near future, so far as this can be forecasted.

PURPOSE OF WORK

To obtain information on the area necessary for planning the field organization for Ribes eradication and methods of procedure, such as amount of equipment and chemicals, volume and type of work, and data for a base map.

LOCATION AND DESCRIPTION OF THE AREAS

Pre-eradication on areas selected by the Potlatch Timber Protective Association officials (in the Association) are located in townships 38, 39 and 40 north, ranges 1, 2 and 3 east, Boise Meridian.

The areas pre-eradicated on the Clearwater Timber Protective Association are in townships 38, 39 and 40 north, ranges 4, 5 and 6 east, Boise Meridian. More specifically this includes the portion of Reed's Creek drainage not eradicated of Ribes in 1929.

The Clearwater National Forest pre-eradicated area is in townships 37, 38 and 39 north, ranges 7 and 8 east, Boise Meridian.

These areas are all within the white pine type and are all in the same geographic region. This region, in the north central portion of Idaho is a rough, rugged area having large streams with numerous small tributaries. There is a variation in elevation of from three thousand to seven thousand feet. In general, it represents a part of the region of maximum *R. petiolare* abundance.

PROCEDURE AND METHODS

Pre-eradication was carried on from September 15 to October 10, following the close of the eradication camps.

The procedure in securing data is explained in detail in the 1928 annual report "Pre-eradication on the Clearwater National Forest". Men experienced in Ribes eradication were used in carrying on the work of pre-eradication.

RESULTS OF WORK

Since eradication of Ribes was limited to the stream type pre-eradication was thereby considerably simplified. Table No. 1 shows the results of pre-eradication on the three areas:

TABLE NO. 1.

RESULTS OF PRE-ERADICATION 1929

Area	Stream Type Acreage to be Sprayed			Stream Type Acreage to be Hand-pulled			Actual Stream Type to be Worked	Area to be Protected by Stream Type Ribes Eradication
	Type L	Type M	Type H	Type B	Type C	Type D		
Clearwater N. F.	625	548	233	535	717	168	2,826	35,000
Clearwater T.P.A.	133	205	10	370	530	363	1,611	32,000
Potlatch T.P.A.	437	199	24	1,346	168	90	2,264	60,000
Total	1,295	952	267	2,251	1,415	621	6,701	127,000

In addition to the acreage listed in the table about 100,000 acres more were examined in an extensive manner on the Clearwater National Forest. The men who did the work felt that the tremendous cost necessary to eradicate Ribes from this particular area would not be justified due to the poor quality of white pine reproduction present.

It will be noted that the percentage of the total area pre-eradicated on the Clearwater and Potlatch Associations which is classed as stream type is less than was the case on areas eradicated in 1929. On pre-eradication only actual stream type area is shown. On eradication it is necessary to work a narrow strip bordering stream type in addition to actual stream type because this border always has numerous Ribes bushes diminishing in density as distance from stream type becomes

greater. This extra acreage is included at the time of eradication but not at the time of pre-eradication because it is such an invariable that it can always be accurately allowed for in estimates.

Another reason for lower stream percentage on the Potlatch Association is the large acreage centering west of Big Island where stream type had no Ribes and was not included in the stream type acreage of Table No. 1.

CONCLUSION

The prospect of continued eradication on the Clearwater National Forest was the reason for preeradication in the Oxford and Bungalow ranger districts. This region, on the western boundary of the forest and due north of the Musselshell district, (partly eradicated in 1929) is in the timbered portion of the forest.

RECOMMENDATIONS

1. Continue employment of men trained in Ribes eradication for use on pre-eradication crews.

2. Start pre-eradication as early in fall as possible before fall rains come.

3. Discontinue pre-eradication in early spring due to snow and high water preventing satisfactory results.

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COOPERATIVE LOCAL CONTROL,
CLEARWATER TIMBER PROTECTIVE ASSOCIATION

By
B. A. Anderson,
Junior Forester.

INTRODUCTION

Late in the summer of 1928 white-pine blister rust was found on the north and south forks of Reed's Creek in the vicinity of Headquarters, Idaho, on the lands of the Clearwater Timber Protective Association. All infections found were on the leaves of Ribes petiolare (wild black currant). Although no infected pines were found indications were that the Ribes infection was of local origin. This belief was later verified by the finding of pine infection in this region during August 1929. The pine infection was on 1923 wood.

The finding of blister rust infection was partially responsible for the final selection of the Reed's Creek drainage by the Clearwater Timber Protective Association as the location for initial cooperative Ribes eradication. Since the final selection of the area was not made until late in the spring of 1929 it was not possible to make the usual pre-eradication survey. However, it was possible for two men to go over the area in an extensive manner and obtain some needed information. Furthermore, the area had been covered by reconnaissance crews in previous years. Hence, a great deal was known of the difficulties to be met by the time work was started.

LOCATION AND DESCRIPTION OF AREA

The Reed's Creek drainage lies within townships 37, 38 and 39 north and ranges 2, 4, 5 and 6 east, Boise Meridian. The general plan was to begin at the head of the drainage and proceed as far down toward the mouth as time and funds would permit. The map accompanying this report shows the bounds of the eradicated area. Headquarters, Idaho was the hub around which operations centered.

The entire area protected is heavily timbered largely with pure stands of white pine with nearly all age classes represented but most of which falls within the "mature" or "just coming mature" class. There are no recent large burns within the acreage protected although the "Scofield burn" dipped into the northeast corner of the area. Hence, from the standpoint of pine values protected it is doubtful if a wiser choice could have been made. The fact that the Clearwater Timber Company, the principal owner of white-pine land in the region, is definitely committed to a policy of sustained yield management of its timber lands further enhances the economic valuation of control work done.

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The Reed's Creek drainage lies within townships 37, 38 and 39 north and ranges 3, 4, 5 and 6 east, Boise Meridian. The general plan was to begin at the head of the drainage and proceed as far down toward the mouth as time and funds would permit. The map accompanying this report shows the bounds of the eradicated area. Headquarters, Idaho was the hub around which operations centered.

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The topography of the region may be classed as gentle. Excellent soil and abundant rainfall result in dense flora and heavy timber stands. Numerous side drainages have networks of tributaries which fan out into numerous smaller tributaries, seepages and flat swampy areas. The aggregate is an area having an unusually heavy percentage of the total acreage classed as stream type. On the main stream and main tributaries extensive beaver dam areas greatly magnify the "difficulty of working" factor.

R. petiolare occurred along practically every stream in concentrations varying from light to heavy with medium predominating. Patches of R. petiolare were almost invariably found at and near the sources of the tributaries. R. lacustre was found to be fairly uniformly distributed over the entire area but very little R. inerme was found.

A network of main trails, in addition to the one road made the area fairly accessible. However, it was necessary to build temporary contact trails over which it was possible to take pack stock loaded with chemical to the spots where needed. In addition to this the Clearwater Timber Company officials were very accommodating in the matter of hauling supplies and equipment to camps located along Alder Creek which territory is traversed by the logging railroad.

Very little logging has been done in the Reed's Creek drainage. Wherever cutting has been done the timber has largely been logged to a 14" (D.B.H.) diameter limit, the slash disposed of and the area in general left in excellent condition for a new crop of white pine.

PURPOSES OF WORK

1. To continue complete eradication of all Ribes in the stream type of white-pine areas.

2. To establish a control program on private and state lands to be carried on in the future, and to develop a personnel for future work.

METHODS AND EQUIPMENT

Two camps of approximately 23 men each were employed, one at the mouth of Deer Creek and the other on Loop Creek near its junction with Alder Creek. The original plan was to haul all equipment and all supplies by Government owned Ford truck but heavy rains in June rendered the roads impassable by motor vehicle until early in July. Hence it was necessary to

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METHODS AND EQUIPMENT

Two camps of approximately 25 men each were employed, one at the mouth of Deer Creek and the other on Deep Creek near its junction with Alder Creek. The original plan was to haul all equipment and all supplies by Government owned Ford truck but heavy rains in June rendered the roads impassable by motor vehicle until early in July. Hence it was necessary to

rely upon a team and wagon for a part of the hauling while the balance, due to the cooperation of the Clearwater Timber Company officials, was hauled on the logging railroad.

Three buildings were rented from the Clearwater Timber Protective Association and used to house a part of the Deer Creek camp, the rental fee for all summer being less than would have been the cost of constructing other quarters.

Two pack horses were used to distribute chemical to crews. For this purpose it was necessary to build approximately fourteen miles of passable horse trails along the north and south forks of Reed's Creek where existing trails did not adequately meet the needs of eradication crews. These trails, while not graded, can be utilized in the future as emergency fire trails. A small amount of chemical was back-packed to remote patches of R. petiolare.

It became necessary to establish small auxiliary camps (fly camps) on upper Alder Creek, the north and south forks of Reed's Creek and on Deer Creek, to work areas which were too far from main camps to be worked conveniently from them as bases.

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The following tables show a summary of the work accomplished on the Clearwater Timber Protective Association in 1929:

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RESULTS OF WORK

The following tables show a summary of the work accomplished on the Clearwater Timber Protective Association in 1929:

TABLE NO. 1.

RESULTS RIBES ERADICATION - CAMP 1.

	Man-Days			Ribes Eradicated				Acres Worked	Gallons Spray Used
	Crewman	Foreman	Total	R. lacustre	R. petiolare	R. inerme	Total	Total	
Hand pulled	319	80 1/4	399 1/4	91,375	14,799	2,912	109,086	419.0	
Sprayed	640	174.3/4	814 3/4					386.8	17,384
Total	959	255	1,214	91,375	14,799	2,912	109,086	805.8	17,384

TABLE NO. 2.

RESULTS RIBES ERADICATION - CAMP 2.

	Man-Days			Ribes Eradicated				Acres Worked	Gallons Spray Used
	Crewman	Foreman	Total	R. lacustre	R. petiolare	R. inerme	Total	Total	
Hand pulled	388 3/4	138	526 3/4	135,119	8,162	766	144,047	481.8	
Sprayed	495	130 1/4	625 1/4					548.9	7,845
Total	883 3/4	268 1/4	1,152	135,119	8,162	766	144,047	1,030.7	7,845

TABLE NO. 3.

RESULTS RIBES ERADICATION BY BOTH CAMPS COMBINED

	Man-Days			Ribes Eradicated				Acres Worked	Gallons Spray Used
	Crewman	Foreman	Total	R. lacustre	R. petiolare	R. inerme	Total	Total	
Hand pulled	1,707 3/4	218 1/4	926	226,494	22,961	3,678	253,133	900.8	
Sprayed	1,135	305	1,440					935.7	25,229
Total	1,842 3/4	523 1/4	2,366	226,494	22,961	3,678	253,133	1,836.5	25,229

Due to the manner in which R. petiolare grows in dense clumps and masses it is impossible to count bushes sprayed. For this reason the tables shown have no accurate measure of the amount of R. petiolare destroyed. This might be given in feet of live stem but even so, only a rough estimate could be made.

The only measure of R. petiolare concentrations so far deemed practicable to make in the field is to record areas sprayed under three possible classifications. These classes are: light, medium and heavy, usually referred to as L., M., and H. Light concentrations include areas on which roughly from one to three per cent of the ground is covered by R. petiolare. In the same manner the percentage limit for M. and H. are 4-24 per cent and 25 per cent and up, respectively. The following table of spraying results demonstrates this method of classifying:

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TABLE NO. 4.

RESULTS OF RIBES ERADICATION BY SPRAYING METHODS

	Eradication Class												Total			
	Light				Medium				Heavy							
	Man-Days	Acres	Gals. Spray	Acres Per Man-Day	Man-Days	Acres	Gals. Spray	Acres Per Man-Days	Man-Days	Acres	Gals. Spray	Acres Per Man-Day	Man-Days	Acres	Gals. Spray	Acres Per Man-Day
Camp 1	239	150.6	4,334	.63	348 1/2	161.7	7,063	.47	227 1/4	74.5	5,987	.33	814 3/4	386.8	17,384	.47
Camp 2	164 1/8	194.0	1,482	1.18	326 1/2	262.7	4,301	.80	134 1/2	92.2	2,062	.69	625 1/4	548.9	7,845	.88
Both	403 1/8	344.6	5,816	.85	675	424.4	11,364	.63	361 3/4	166.7	8,049	.46	1,440	935.7	25,229	.65

The results by camp of hand pulling are shown in the following table:

TABLE NO. 5.

RESULTS BY HAND-PULLING ERADICATION METHOD.

		Ribes Eradicated					Total	
	Acres Worked	R. petiolare	R. lacustre	R. inerme	Total	Per Acre	Man-Days	Acres Per Man-day
Camp 1	419.0	14,799	91,375	2,912	109,086	260	399 1/4	1.05
Camp 2	481.8	8,162	135,119	766	144,047	299	526 3/4	0.91
Both	900.8	22,961	226,494	3,678	253,133	281	926	0.97

STATEMENT AND ANALYSIS OF COSTS

TABLE NO. 6.

DISTRIBUTION OF COSTS BY CAMPS.

Item		Cost		
		Camp No.1	Camp No.2	Total
Salaries	Supervisors	$ 1,300.00	$ 700.00	$ 2,000.00
	Temporary men	4,299.74	4,489.43	8,789.17
Subsistence	Salaries of cooks	437.67	475.72	913.39
	Cost of food	2,061.71	1,925.86	3,987.57
	Transp. of food	228.34	241.10	469.44
General equipment	Cost	353.44	353.43	706.87
	Transportation	74.01	74.01	148.02
Spraying equip.		141.27	141.27	282.54
Miscellaneous	Supplies	76.15	76.15	152.30
	Expenses	67.21	67.21	134.42
	Repairs	39.62	39.62	79.24
	Twine	35.00	35.00	70.00
Chemical	Cost	2,114.28	981.72	3,096.00
	Transportation	250.88	130.00	380.88
Transportation men		252.39	220.69	473.08
Checking		375.00	375.00	750.00
Total		$12,106.71	$10,326.21	$22,432.92

The above table shows the actual expenditures against each camp unit and the total for the entire period May 1 to October 31, inclusive. While actual eradication was conducted from June 15 to September 15 only, the balance of the period should be charged against the job because of time required for preparation and for pre-eradication in the fall.

TABLE NO. 7.

COST OF ERADICATION BY CAMP UNITS.

Camp No.	Cost of Hand Eradication			Cost of Chemical Eradication			Cost of Both Combined		
	Acre-age	Cost	Cost Per Acre	Acre-age	Cost	Cost Per Acre	Acre-age	Cost	Cost Per Acre
1	419.0	$3,169.08	$7.56	386.8	$8,937.63	$23.11	805.8	$12,106.71	$15.02
2	481.8	4,146.36	8.61	548.9	6,179.85	11.26	1,030.7	10,326.21	10.02
Both	900.8	$7,315.44	$8.12	935.7	$15,117.48	$16.56	1,836.5	$22,432.92	$12.22

Total area protected from the rust (in so far as stream type eradication will protect) 21,500 acres. The 21,500 acres is the area from which Ribes were eradicated in the stream type.
Average cost per acre protected is $1.04.

On the report sent to the Clearwater Timber Protective Association at the end of the 1929 field season the total cost of the operation was given as $30,000.00. This charge was justified by necessity of carrying a skeleton supervisory organization the full year. Furthermore, considerable expense is involved for miscellaneous supplies, warehousing, equipment, overhauling, etc. Considering $30,000.00 as the total cost of Ribes eradication on the Clearwater Timber Protective Association for the year May 1, 1929 to April 30, 1930, the average cost for protecting each acre of white pine timber within the protection zone was $1.40.

Cost of Subsistence

The following table shows the manner in which meal costs were computed, the relative cost for each item involved, the number of meals served and the average cost of each.

TABLE NO. 8.

COST OF MEALS

Camp No.	Cost of Items				Number Meals Served	Average Cost Per Meal
	Cooks' Salaries	Food Costs	Transporting Food	Total Cost		
1	$437.67	$2,061.71	$ 228.34	$2,727.72	5,880	$0.4639
2	475.72	1,925.86	241.10	2,642.68	5,508	0.4798
Both	$913.39	$3,987.47	$469.44	$5,370.40	11,388	$0.4717

CHECKING THE EFFICIENCY OF RIBES ERADICATION

It was arranged early in the spring of 1929 to turn over the checking or inspection of work to be done to the men who have been engaged upon studies under project 4. It was felt that these men would be better fitted, due to their wide experience with the rust under varying conditions, to place a better valuation upon the work done, especially in terms of rust control.

Since checking efficiency of work is a necessary part of the operation, it is a logical charge against protection and a nominal allowance for checking was made. It was found that checking could be done satisfactorily by having one man attached to each camp for that purpose.

A report on effectiveness of eradication work done on the Clearwater Timber Protective Association is included elsewhere in the 1929 Annual Report of the Western Office.

RECOMMENDATIONS FOR FUTURE WORK

1. The advent of stream type eradication brought up a problem which was only partially foreseen. It has been the custom in the past to employ about 25 to 28 men in each camp. This custom is the result of certain experiments designed to strike a proper balance between a small, very mobile unit with necessarily high overhead costs and a larger unit with proportionately less charge against overhead.

It was decided, previous to starting work in June, 1929, that the size of camp should be reduced somewhat due to plans to work only stream type. About 21 to 23 men were employed in each camp. Even this size camp proved too large due to the heavier equipment necessary and the resultant immobility. It is therefore recommended that a still smaller unit be employed in the future where only stream type eradication is to be done.

TABLE NO. 5

COST OF MEALS

Camp No.	Cost of Items: Cooks' Salaries	Food Costs	Transporting Food	Total Cost	Number Meals Served	Average Cost per Meal
1	$457.67	$2,061.71	$ 228.34	$2,727.72	5,880	$0.4639
2	475.72	1,925.36	241.10	2,642.68	5,508	0.4798
Both	$913.35	$3,987.47	$469.44	$5,370.40	11,388	$0.4717

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The employment of smaller units will very likely do away with the necessity for fly camps, mentioned earlier in this report.

2. During the progress of the operation R. petiolare bushes which were partially submerged by the high water at the time of original spraying, early in the season, sent forth sprouts as soon as the water receded. The result was a line of sprouts along either bank of the streams which necessitated a respraying operation at a later date.

It is suggested for the future that, whenever feasible, men be employed on hand pulling on upland streams until the water recedes before starting spraying operations on areas where bushes of R. petiolare are partially submerged.

3. The special grade of two-ply sewing twine used to mark boundaries of eradicated areas proved too weak. Three-ply sewing twine (with the smallest diameter possible to obtain) proved most satisfactory.

4. The reinforced "Brown" double-action hand pump proved very durable and entirely satisfactory as a means of spraying chemical on bushes.

5. Every man preferred the oval tank which straps on the "Trapper Nelson Pack Board" over the special tank designed and patented by personnel of this office. It is therefore recommended that the oval tank be adopted for future work or until such time as a better tank is made.

6. It is sometimes necessary to pack drums of chemical over temporarily constructed trails very difficult for a horse or mule to traverse with a heavy load. It was found that two 100-pound drums (111 lbs. including the weight of the container) were too much for one animal under these conditions. It is therefore recommended that containers which will hold 50 pounds net be provided or that 20 or 25 per cent of the chemical to be used be purchased in containers of that size.

W.736-Typical scene in the white pine region of the Clearwater Timber Protective Association.

W.849-This area was closely grazed by sheep after the *Ribes petiolare* was thoroughly sprayed with sodium chlorate with no ill effects on the sheep.

RESULTS OF CHECKING ON THE AREAS ERADICATED OF RIBES IN THE CLEARWATER TIMBER PROTECTIVE ASSOCIATION, IDAHO, 1929

by

H. N. Putnam
Associate Pathologist

The streams eradicated in the Reed's Creek drainage in 1929 were quite effectually checked with the exception of a portion of the North Fork of Reed's Creek, which was not completely eradicated of Ribes in 1929.

Tables No. 1 and 2 show the results of the checking by means of permanent and temporary check plots.

TABLE NO. 1

RESULTS OF CHECKING ERADICATED AREAS OF CLEARWATER TIMBER PROTECTIVE ASSOCIATION, IDAHO, BY PERMANENT PLOTS, 1929

Streams	Eradication Status	Number		% Concentration		Ribes Feet Live Stem Per Acre				Per Cent of Efficiency by Live Stem
		Plots	Mil-acres	Area Containing Ribes	Actual Area of Ribes	R. petiolare	R. inerme	R. lacustre	Total	
South Fork Reed's Creek, Deer Creek	Before Eradication	70	2,080	13.4	8.8	32,868	0	1,581	34,449	
	After Eradication	40	1,214	-	-	409	0	0	409	98.8
Alder Creek, Loop Creek, North Fork Reed's Creek	Before Eradication	59	1,904	8.2	5.9	17,309	118	2,422	19,849	
	After Eradication	40	1,418	-	-	154	0	358	512	97.4

TABLE NO. 2

RESULTS OF CHECKING ERADICATED AREAS OF CLEARWATER TIMBER PROTECTIVE ASSOCIATION, IDAHO BY TEMPORARY PLOTS, 1929

Streams	Number		Ribes Per Acre Left After Eradication									
			R. petiolare		R. inerme		R. viscosissimum		R. lacustre		Total Ribes	
	Plots	Milacres	Bushes	F.L.S.	Bushes	F.L.S.	Bushes	F.L.S.	Bushes	F.L.S.	Bushes	F.L.S.
S. Fork Reed's Creek	649	11,420	5	101	0	0	Trace	1	6	211	11	313
Deer Creek	382	7,754	2	28	0	0	Trace	Trace	3	74	5	102
Alder Creek	723	12,738	4	69	Trace	18	0	0	14	364	18	451
N. Fork Reed's Creek	55	816	6	1,109	0	0	0	0	18	141	24	1,250

A study of Tables 1 and 2 will show that with the exception of the North Fork of Reed's Creek, a larger volume of Ribes per acre was left on the main streams, as represented by the permanent check plots, than on the tributaries as represented by the temporary check plots. This is probably due to the fact that Ribes occurred in their greatest abundance on the larger streams.

Again, it may be noted that, with the exception of the North Fork of Reed's Creek, R. petiolare constituted the bulk of Ribes left on areas checked by permanent plots, and R. lacustre on areas checked by temporary plots.

The North Fork of Reed's Creek showed the largest amounts of Ribes left per acre. This fact may be explained partly because the check of the area was not sufficient to give a true picture, and partly because eradication work was done at the end of the season when efficiency is apt to be low. Men are getting tired at the end of the season and their minds are occupied with thoughts of the coming school year. This condition results in poorer work being done.

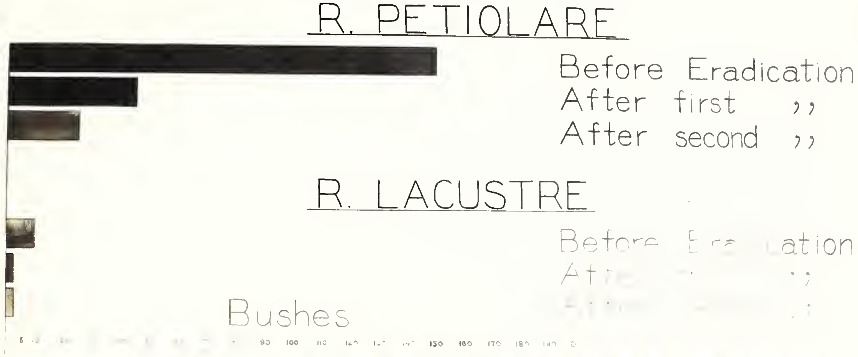
Certain permanent plots were inspected after the application of one spray to the area and again examined after the second spray. Table No. 3 shows the results of this checking reduced to a per-acre basis. This information is shown also in the accompanying graphs which are based on figures in Table No. 3.

TABLE NO. 3

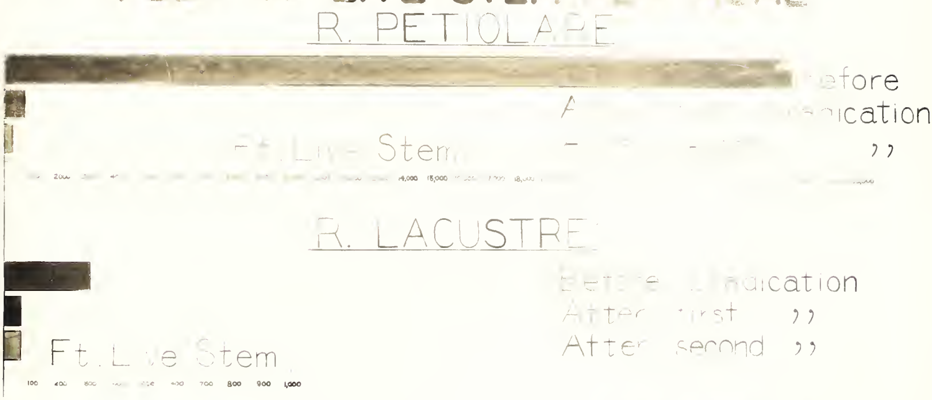
EFFECT OF ONE AND TWO SPRAY APPLICATIONS ON ERADICATION AREAS OF CLEARWATER TIMBER PROTECTIVE ASSOCIATION, IDAHO, 1929, BASED ON THIRTY-FOUR PERMANENT PLOTS HAVING 1252 MILACRES

Eradication Status	R. petiolare Per Acre					R. lacustre Per Acre					Total Ribes Per Acre				
			F.L.S. Per	% Efficiency By				F.L.S. Per	% Efficiency By				F.L.S. Per	% Efficiency By	
	Bushes	F.L.S.	Bush	Bushes	F.L.S.	Bushes	F.L.S.	Bush	Bushes	F.L.S.	Bushes	F.L.S.	Bush	Bushes	F.L.S.
Before Eradication	149	27,381	184			10	294	29			159	27,675	174		
After One Spray	45	665	15	69.8	97.6	2	11	6	80	96.2	47	676	14	70.4	97.6
After Two Sprays	25	252	10	83.2	99.1	2	11	6	80	96.2	27	263	10	83.0	99.0

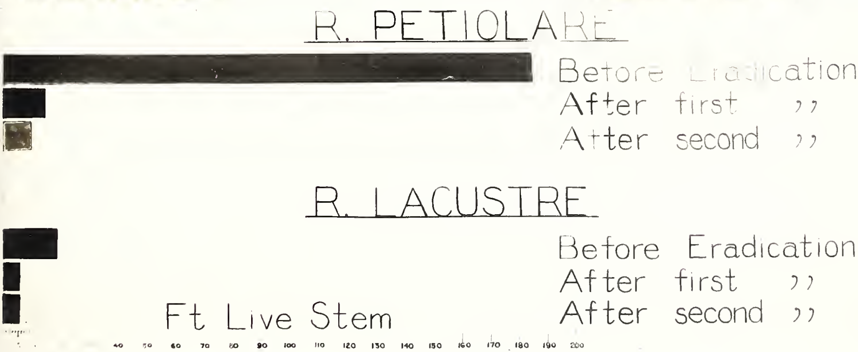
BUSHES PER ACRE



FEET OF LIVE STEM PER ACRE



AVERAGE FEET OF LIVE STEM PER BUSH



An examination of Table No. 3 shows that on the plots checked R. petiolare constituted nearly 99% of the Ribes before eradication and that eradication reduced the feet of live stem of R. petiolare to approximately that of R. lacustre before eradication.

It is apparent that while the per cent of efficiency of R. petiolare eradication by bushes, or locations, is relatively low, by feet of live stem it is high. This relationship is also shown in the reduction in feet of live stem per location following the first and second eradication.

Much of the R. petiolare live stem surviving one eradication consisted of stems of bushes under water at the time of first spraying. The second eradication killed a considerable number of these. The bushes surviving the second eradication were largely missed bushes.

It may be observed that the second eradication showed no effect upon R. lacustre. This was because very little attempt was made to hand pull Ribes at the time of the second eradication.

From the standpoint of Ribes eradication a good job was done on the Clearwater Timber Protective Association. It remains to be seen whether or not sufficient protection was afforded the pines. Since blister rust is already established on or near the areas worked we should be able to obtain valuable data on this point in the future.

A plot of 2.1 acres on Deer Creek was laid off in 1929 on which only one spray was applied, and this early in the season. Data were taken relative to location of bushes, feet of live stem missed and stems under water when sprayed. This plot will be examined next year. The object of this study is to ascertain the effect of one spray early in the season upon the Ribes present.

An examination of Table No. 4 shows that on the plots checked R. petiolare constituted nearly 93% of the Ribes before eradication and that eradication reduced the feet of live stem of R. petiolare to approximately that of R. lacustre before eradication.

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COOPERATIVE LOCAL CONTROL
POTLATCH TIMBER PROTECTIVE ASSOCIATION
By
W. G. Guernsey
Junior Forester

INTRODUCTION.

Practical Ribes eradication was carried on in the stream type of the timber areas on the Potlatch Timber Protective Association during the past summer. Stream type is the mixture of trees and herbaceous growth bordering streams with numerous concentrations of wild Ribes generally present.

The eradication operations on this association were the result of an agreement between the Timber Protective Association and the Office of Blister-Rust Control. The agreement was made with the stipulation that for every dollar of association money expended the Office of Blister-Rust Control should spend two dollars with the actual field supervision in the hands of the Office of Blister-Rust Control. The total amount to be expended in the fiscal year 1930 was to be $30,000.00.

A report was made to the Potlatch Timber Protective Association before the field work started stating the basis and nature of expenditures and work to be carried on during the field season, thus assisting the officials of the association in keeping track of the operations.

PURPOSES OF WORK

The purposes of the 1929 work in practical eradication of the hosts of white-pine blister rust on the Potlatch Timber Protective Association were:

1. To continue complete eradication of all Ribes in the stream type of white-pine areas.

2. To establish a control program on private and state lands to be carried on in the future, and to develop a personnel for future work.

LOCATION AND DESCRIPTION OF THE AREA.

Two camps operated on the Potlatch Timber Protective Association which is located in the north central part of Idaho.

The personnel of Camp 1 operated on the headwaters of the East Fork of Potlatch Creek, township 41 north, ranges 1, 2 and 3 east, Boise

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Meridian and was later moved to Round Meadow Creek, township 39 north, range 1 east, Boise Meridian.

Camp 2 operated in the Gold Creek drainage, township 40 north, ranges 3 and 4 east; Deep Creek, township 39 north, range 2 east; and on lower Long Meadow Creek, township 39 north, range 1 east, Boise Meridian.

Mature white pine predominated on the upper East Fork of Potlatch Creek, Gold Creek and Deep Creek drainages. The areas surrounding Round Meadow and Long Meadow Creeks were mainly white-pine type with about twenty per cent pole class and the rest mature white pine.

METHODS, EQUIPMENT AND MATERIALS

The general methods, equipment and chemicals used are explained in detail in the introductory notes of the eradication report. These eradication methods were used on all the projects and are incorporated early in the report to prevent repetition by each eradication project leader.

A G.M.C. truck, one and one-half-ton capacity, purchased in 1927, was used to handle the transportation of supplies, equipment and men.

A one-half-ton Ford truck was used by the project leader to haul general supplies back and forth between camps and in moving small details of men to fairly distant parts of the eradication blocks.

A pack string consisting of six mules and a saddle horse was hired to transport supplies and equipment to camps off the roads. It was also necessary to move chemicals to points along streams where it was available for the chemical spraying crews.

The main warehouse was in Elk River and the packer and pack string were headquartered there to facilitate trips to the camps.

For short periods the camps were situated on passable roads and during that time it was very convenient to use the G.M.C. truck in moving supplies direct to camp. It was so arranged, however, that the pack string was kept busy during the entire season.

WORK PERFORMED AND RESULTS

TABLE NO. 1

SUMMARY OF RESULTS OF RIBES ERADICATION BY HAND PULLING METHODS ON THE POTLATCH TIMBER PROTECTIVE ASSOCIATION
1929

Type	Camp No.	Ribes Pulled: R. lacustre	R. visco.	R. petiolare	R. irriguum	R. inerme	Total	Man-Days: Crewman	Foreman	Acres	Ribes Per Acre
Stream	1	405,827	3,521	9,928		1,427	420,703	887.5	305.5	1,041.7	403
Dense pole	1	12,335	6,425				18,760	68.0	32.0	300.0	62
Stream	2	319,557	368	17,000	4,996		341,921	651.0	270.0	1,576.3	216
Total	1-2	737,719	10,314	26,928	4,996	1,427	781,384	1,606.5	607.5	2,918.0	267

The dense pole type worked by Camp 1 was made necessary by the finding of a concentration of blister-rust infection near the junction of Three Bear and Long Meadow Creeks.

TABLE NO. 2

SUMMARY OF THE RESULTS OF SPRAYING RIBES PETIOLARE ON THE POTLATCH TIMBER PROTECTIVE ASSOCIATION.

Eradication Class	Camp No.	Time		Acres	Gallons Spray
		Crewmen	Foreman		
M	1	146	29	76.1	5,883
M	2	178	47	105.3	3,976
M	Total	324	76	181.4	9,859

The concentration of Ribes varied considerably over the areas sprayed but it was found that the average was a medium class and was recorded as such in this report.

A. General Statement and Analysis of Costs of Ribes Eradication on the Potlatch Timber Protective Association

TABLE NO. 3

COST OF OPERATION.

Item		Cost		
		Camp No. 1	Camp No.2	Total
Salaries	Supervisors	$ 791.66	$ 791.66	$ 1,583.32
	Temporary men	5,048.70	4,432.24	9,480.94
Subsistence	Salaries of cooks	549.68	528.88	1,078.56
	Cost of food	1,951.19	1,687.58	3,638.77
	Trans. of food	471.36	478.66	950.02
General equipment	Cost	353.43	353.43	706.86
	Transportation	212.85	212.85	425.70
Spraying equipment		141.27	141.27	282.54
Miscellaneous	Supplies	95.27	95.27	190.54
	Expenses	82.75	82.75	165.50
	Repairs	39.62	39.63	79.25
	Twine	40.00	40.00	80.00
Chemical	Cost	352.85	296.12	648.97
	Transportation	127.39	127.39	254.78
Transportation of men		156.02	156.01	312.03
Checking cost		375.00	375.00	750.00
Total		$10,789.04	$9,838.74	$20,627.78

It will be noted that cost of operation was greater for Camp 1 than for Camp 2. This is accounted for largely by the fact that temporary men in Camp 2 were loaned to the Potlatch Timber Protective Association for two weeks to assist in fire suppression during an emergency and were paid salary and subsisted by the Association for that period. More chemical was used in Camp 1 than was used in Camp 2.

B. Cost of Eradicating Ribes from Stream Type by Each Camp Unit.

TABLE NO. 4.

COST OF ERADICATION

Camp Number	Cost of Hand Eradication			Cost of Chemical Eradication			Cost of Combined Eradication		
	Acreage	Cost	Cost Per Acre	Acreage	Cost	Cost Per Acre	Acreage	Cost	Cost Per Acre
1	1,041.7	$ 8,255.56	$7.92	76.1	$1,844.76	$24.24	1,117.8	$10,100.32	$9.04
1 (Infected Area)	300.0	692.00	2.30				300.0	692.00	2.30
2	1,576.3	7,441.68	4.72	105.3	2,393.88	22.73	1,681.6	9,835.46	5.86
Averages & Totals	2,918.0	$16,389.24	$5.60	181.4	$4,238.64	$23.36	3,009.4	$20,627.78	$6.65

The average cost per acre for the 57,010 acres protected by stream type eradication was $0.36. The 57,010 acres represent the area on which Ribes were eradicated from stream type and is explained in the general statement "Ribes Eradication in North Idaho".

In the report sent to the Potlatch Timber Protective Association at the end of the 1929 field season the total cost of the operation was given as $30,000.00. This charge was justified by the necessity of carrying a skeleton supervisory organization the full year. Furthermore, considerable expense is involved for miscellaneous supplies, warehousing, equipment overhauling, etc. Considering $30,000.00 as the total cost of Ribes eradication on the Potlatch Timber Protective Association for the year May 1, 1929 to April 30, 1930, the average cost for protecting each acre of white pine timber within the protection zone was $0.53.

C. Cost of the Meals Served in the Eradication Camps.

TABLE NO. 5

COST OF MEALS.

Camp No.	Cooking Salary	Cost of Food	Transportation of Food	Total Subsistence Cost	Number of Meals	Average Cost Per Meal
1	$ 549.68	$1,951.19	$471.36	$2,972.23	6,241	$0.4764
2	528.88	1,687.58	478.66	2,695.12	5,299	0.5184
Total	$1,078.56	$3,638.77	$950.02	$5,667.35	11,540	$0.4911

D. Checking the Effectiveness of Ribes Eradication.

Checking to determine the effectiveness of Ribes eradication as a control measure was undertaken by the personnel of Project 4. A report on the results follows this report. The cost of checking, $750.00 is a necessary item of the cost of Ribes eradication and is reflected or shown in the statements in Tables 3 and 4.

E. Ribes Eradication on the Area Infected with Blister Rust.

The discovery of a center of pine infection at the mouth of Three Bear Creek in township 39 N., range 1 E., Boise Meridian made necessary eradication of Ribes from the entire area on which infected pines were found plus a protective boundary. This resulted in the

working of 300 acres not classed as stream type. The acreage so worked is shown separately as "infected area" in Table 4 and as "dense pole" in Table 1.

RECOMMENDATION FOR FUTURE WORK

There is a consensus of opinion in favor of smaller stream type eradication units. Working only the stream type results in necessity of frequent moves. Fewer men employed per camp would result in less frequent moving of the camp and permit using more mobile equipment.

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W.748-Concentration of Ribes petiolare before spraying.

W.740-Ribes petiolare concentration two weeks after being sprayed showing dead leaves and twigs.

RESULTS OF CHECKING ON THE AREAS ERADICATED OF RIBES IN THE POTLATCH TIMBER PROTECTIVE ASSOCIATION, IDAHO - 1929.

By
H. N. Putnam,
Associate Pathologist.

Streams eradicated in 1929 in the East Fork of Potlatch Creek, Gold Creek, Deep Creek and Meadow Creek drainages were satisfactorily checked in 1929.

Tables Nos. 1 and 2 show the results of checking these areas by means of permanent and temporary check plots.

TABLE NO. 1.

RESULTS OF CHECKING ERADICATED AREAS OF POTLATCH TIMBER PROTECTIVE ASSOCIATION, IDAHO BY PERMANENT PLOTS - 1929.

Streams	Eradication Status	Number		% Concentration		Ribes Feet Live Stem Per Acre				Per Cent of Efficiency by Live Stem
		Plots	Mil-acres	Area Containing Ribes	Actual Area of Ribes	R. petiolare	R. inerme	R. lacustre	Total	
East Fork, Potlatch Creek and Mallory Creek	Before erad.	20	540	24.8	11.0	60,056	19	36,476	96,551	
	After erad.	13	458	-	-	192	11	391	594	99.4
Deep Creek	Before erad.	24	516	7.1	3.5	9,087	(R.irrig.) 407	4,035	13,529	
	After erad.	18	410	-	-	22	0	290	312	97.7
Gold Creek	Before erad.	3	84	38.7	19.5	60,964	0	66,667	127,631	
	After erad.	Not checked on account of sheep having eaten foliage.								

TABLE NO. 2.

RESULTS OF CHECKING ERADICATED AREAS OF POTLATCH TIMBER PROTECTIVE ASSOCIATION, IDAHO, BY TEMPORARY PLOTS, 1929.

Area	Number		Ribes Per Acre After Eradication							
			R. petiolare		R. viscosissimum		R. lacustre		Total Ribes	
	Plots	Milacres	Bushes	F.L.S.	Bushes	F. L. S.	Bushes	F.L.S.	Bushes	F.L.S.
East Fork, Potlatch Creek and Mallory Creek	964	19,852	1	11	0	0	19	674	20	685
Deep Creek	358	11,200	1	14	0	0	18	259	19	273
Meadow Creek	406	9,822	0	0	0	0	19	237	19	237
Long Meadow Creek Infection Area	16	1,820	0	0	7	85	22	145	29	230
Gold Creek	558	20,214	1	70	0	0	21	432	22	502

The large amount of Ribes per acre, 127,631 feet of live stem, as shown in Table No. 1 on Gold Creek before eradication, is not at all representative of average conditions. The three plots on which this figure is based, are located in the region of greatest Ribes abundance.

In Table No. 1 there may be noted an example of the fallacy of using a per cent efficiency as a measure of effectiveness. On the East Fork of Potlatch Creek there were Ribes left at the rate of 594 feet of live stem per acre, with an efficiency of 99.4 per cent while on Deep Creek there were but slightly more than half the number of feet of live stem per acre, with a 1.7 per cent less efficiency.

Tables No . 1 and 2 show similar results on the same areas checked. In every case the largest bulk of Ribes left consisted of Ribes lacustre. Larger amounts of R. petiolare were left on the areas checked by permanent plots than on those checked by temporary plots, because in the former case the areas checked were limited to the main streams where R. petiolare occurred in greatest abundance.

Table No. 2 shows a quite consistent uniformity in bushes and feet of live stem left. There are three areas on which the feet of live stem varied only from 230 to 273 per acre. It is interesting to note that the amount of Ribes per acre left on the upland type on the Long Meadow infection area is similar to the amounts left on the stream types of Deep and Meadow Creeks. This fact suggests the possibility of the existence of a practical minimum amount of Ribes left after eradication, a further reduction of which would materially increase the cost of eradication.

Strictly from the eradication viewpoint there was a high degree of efficiency of work obtained, and a good job performed. What the results of eradication will be, expressed in effectiveness of control, remains to be determined. Opportunity is afforded for a study of effectiveness of control on two areas where pine infection was found and where eradication work took place. These locations are: (1) Deep Creek, and (2) Long Meadow Creek.

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SCOUTING FOR BLISTER RUST IN NORTHERN IDAHO, 1929

by

E. L. Joy

Junior Forester

INTRODUCTION

In 1927 blister rust was discovered in Idaho for the first time about seven miles north of Priest River. In 1928 the disease was found to be spread over the entire Inland Empire white-pine belt and to be well established in the southern part of this region, that portion just north of the Clearwater River. Consequently, most of the scouting work in 1929 was done in this southern region.

PURPOSE

The purpose of scouting, as in the past, was primarily to determine the extent and intensity of the disease. Work started in 1928, toward a survey of all stream-type in the white-pine belt containing Ribes petiolare and R. inerme was continued in conjunction with scouting.

LOCATION OF WORK

The lands of the Clearwater and Potlatch Timber Protective Associations and the Clearwater National Forest were the regions most intensively scouted. Some scouting was done on the St. Joe National Forest and a scouting trip was made in the Priest River portion of the Kaniksu National Forest where infection was found in 1927 and 1928.

ORGANIZATION OF WORK

A. Spring Scouting.

In an effort to locate pine infection in the St. Maries River drainage near Clarkia, Idaho, where abundant infection on Ribes was found in 1928, a scouting trip was made in May. Four members of the permanent personnel spent two days examining pines in this area.

B. Summer and Fall Scouting.

1. Personnel. Scouting in the summer and fall of 1929 was combined with two other projects, namely, "Checking of Eradication" and

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B. Summer and Fall Scouting.

1. Personnel. Scouting in the summer and fall of 1929 was combined with two other projects, namely, "Checking of Eradication" and

"Disease Studies", all of which were under the supervision of H. N. Putnam, E. L. Joy, R. E. Myers and eight temporary assistants completed the personnel for these projects. Three of the temporary assistants were not used for the entire field season. In addition, scouting was done by members of other projects and a report of this made at the end of the season.

2. Division of Time. During the summer months all men engaged in checking or plot study work scouted in conjunction with this work. Several days during the season were spent on scouting trips in order to keep up the scouting interest. All temporary men were given an opportunity to see the disease on both hosts during the summer.

In the early fall after the checking and plot study work were completed the force devoted its entire time to scouting. Two-man crews were used, each crew having a car.

3. Methods of Work. Stream-type in which R. petiolare and R. inerme are in association with white pine is considered the most favorable scouting chance. This type of area was given chief consideration and scouted intensively by drainages. Emphasis was placed on pine scouting in order to locate as many centers of infection as possible, this information being of great importance in making eradication plans.

The Ribes along the stream and the pines in close association were examined. Particular attention was paid to areas on which infection had been found in previous years.

4. Recording of Data. The two scouting forms previously used, numbers 57 and 38, were used in 1929. Form number 57 is used for a summary report of the scouting performed on a drainage or part of a drainage called an "inspection". Space is provided for recording the width of stream-type and the abundance, number examined and number infected of pines and of Ribes by species.

Form 38 is designed for the recording of data for each infection. It is divided into three parts, the first for the individual pine infection data, the second for the analysis of the pine cankers found and the third for a detailed analysis of the infection found on Ribes.

Both forms have spaces for such information as the location of the area, the inspector's name and the date of inspection. A space

"Disease Studies", all of which were under the supervision of [illegible], E. L. Joy, H. R. Myers and eight temporary assistants completed the personnel for these projects. Three of the temporary assistants were not used for the entire field season. In addition, scouting was done by members of other projects and a report of this made at the end of the season.

2. Division of Time. During the summer months all men engaged in checking or plot study work scouted in conjunction with this work. Several days during the season were spent on scouting trips in order to keep up the scouting interests. All temporary men were given an opportunity to see the disease on both hosts during the summer.

In the early fall after the checking and plot study work were completed the force devoted its entire time to scouting. Two-man crews were used, each crew having a car.

3. Methods of Work. Stream-type in which R. petiolare and R. inerme are in association with white pine is considered the most favorable scouting chance. This type of area was given chief consideration and scouted intensively by drainages. Emphasis was placed on pine scouting in order to locate as many centers of infection as possible, this information being of great importance in making eradication plans.

The Ribes along the stream and the pines in close association were examined. Particular attention was paid to areas on which infection had been found in previous years.

4. Recording of Data. The two scouting forms previously used, numbers 57 and 58, were used in 1929. Form number 57 is used for a summary report of the scouting performed on a drainage or part of a drainage called an "inspection". Space is provided for recording the width of stream-type and the abundance, number examined and number infected of pines and of Ribes by species.

Form 58 is designed for the recording of data for each infection. It is divided into three parts, the first for the individual pine infection data, the second for the analysis of the pine cankers found and the third for a detailed analysis of the infection found on Ribes.

Both forms have spaces for such information as the location of the area, the inspector's name and the date of inspection. A see

is also provided for a rough sketch map of the area on which can be shown by a color scheme the area supporting R. petiolare, R. inerme and white pine and the location of each infection.

RESULTS OF SCOUTING

A. Combined Results.

The results of scouting done by all projects during the 1929 season have been combined. Following are two tables which show the results of scouting in northern Idaho, Table No. 1 being a summary by counties of all work done and Table No. 2 a detailed account of each infection found.

is also provided for a rough sketch map of the area on which can be shown by a color scheme the area supporting R. nigrum, R. inerme and white pine and the location of each infection.

RESULTS OF SCOUTING

A. Combined Results.

The results of scouting done by all projects during the 1929 season have been combined. Following are two tables which show the results of scouting in northern Idaho, Table No. 1 being a summary by counties of all work done and Table No. 2 a detailed account of each infection found.

TABLE NO. 1

SUMMARY OF SCOUTING IN NORTHERN IDAHO, 1929

County	No. Insp.	No. Inf.	Ribes: R. petiolare Exam.	R. petiolare Inf.	R. inerme Exam.	R. inerme Inf.	R. irriguum Exam.	R. irriguum Inf.	R. visco. Exam.	R. visco. Inf.	R. lacustre Exam.	R. lacustre Inf.	Total Exam.	Total Inf.	Pines Exam.	Pines Inf.
Clearwater	19	9	12,335	34	1,615	0	60	6	774	12	1,498	38	16,282	90	11,955	20
Shoshone	13	5	20,330	20	515	0	0	0	30	0	1,250	0	23,125	20	6,420	40
Latah	2	2	576	1	551	1	0	0	0	0	602	0	1,729	2	85	0
Bonner	4	0	0	0	2,310	0	0	0	0	0	150	0	2,460	0	920	0
Kootenai	1	0	0	0	200	0	0	0	0	0	0	0	200	0	500	0
Total	39	16	33,241	55	5,191	1	60	6	804	12	3,500	38	42,796	112	19,880	60

TABLE NO. 2

SUMMARY OF INFECTIONS IN NORTHERN IDAHO, 1929

Location	Ribes				Pines		
	Species	Examined	Infected	Per Cent Leaves Infected Per Infected Bush	Examined	Infected	Year Origin of Infection
North Fork Reed's Creek 1¾ miles below Headquarters, Idaho. Clearwater County T. 38 N., R. 5 E., Sec. 16.	R. petiolare.	25	0	0			
	R. lacustre.	25	0	0	500	15	1927
Rhodes Creek for 30 chains above old gold dredge Pierce, Idaho. Clearwater County T. 36 N., R. 5, 5 E., Sec. 1,6.	R. petiolare.	200	18	40			
	R. inerme.	5	0	0	2,000	0	
Orofino Creek ¼ mile below old gold dredge, Pierce, Idaho. Clearwater County T. 36 N., R. 5 E., Sec. 13.	R. petiolare.	500	1	1			
	R. lacustre.	25	0	0	150	0	
North Fork Washington Creek 55 chains below trail crossing, Headquarters, Idaho. Clearwater County T. 38 N., R. 6 E., Sec. 20.	R. petiolare.	500	2	10	200	0	
Casey Creek ½ mile above Casey Meadows, Headquarters, Idaho. Clearwater County T. 38 N., R. 5 E., Sec. 5.	R. petiolare.	500	1	5			
	R. lacustre.	25	0	0	100	0	
Beaver Creek 300 feet above Clearwater Timber Co. Camp 9, Headquarters, Idaho. Clearwater County T. 39 N., R. 5 E., Sec. 12.	R. petiolare.	100	1	5	100	0	
Long Meadow Creek ¾ mile above mouth Round Meadow Creek, Elk River, Idaho. Latah County T. 39 N., R. 1 E., Sec. 9.	R. petiolare.	500	0	0			
	R. inerme.	500	1	1			
	R. lacustre.	600	0	0	1,000	0	
Long Meadow Creek at mouth 3 Bear Creek, Elk River, Idaho. Clearwater County T. 39 N., R. 1 E., Sec. 14.	R. lacustre.	78	36	60	5% pines infected over area except 2 centers where 95% pines infected.		
	R. viscosissimum	12	10	75			1923
Junction Deep Creek and Elk Creek, Elk River, Idaho. Clearwater County T. 39 N., R. 2 E., Sec. 14.	R. petiolare.	100	10	15			
	R. irriguum.	60	6	5			
	R. viscosissimum.	12	2	30			
	R. lacustre.	20	2	0.2	500	5	1923
French Creek 3½ miles south Oxford Ranger Station, Pierce, Idaho. Clearwater County T. 37 N., R. 7 E., Sec. 7.	R. petiolare.	50	1	0.2	30	0	
Middle Fork St. Maries River, Clarkia, Idaho. Inspection No. 1. Shoshone County T. 42 N., R. 2 E., Sec. 3, 10.	R. petiolare.	1,800	4	10			
	R. lacustre.	150	0	0	600	1	1923
Middle Fork St. Maries River, Clarkia, Idaho. Inspection No. 2. Shoshone County T. 42 N., R. 2 E., Sec. 8.	R. petiolare.	750	1	1			
	R. inerme.	110	0	0			
	R. lacustre.	210	0	0	650	7	1923
East Fork Merry Creek, Clarkia, Idaho. Shoshone County T. 43 N., R. 2 E., Sec. 34.	R. petiolare.	5,000	4	2			
	R. lacustre.	430	0	0	960	0	
Merry Creek near mouth East Fork, Clarkia, Idaho. Shoshone County T. 43 N., R. 2 E., Sec. 33.	R. petiolare.	2,000	1	2			
	R. lacustre.	200	0	0	70	0	
Gold Center Creek and Middle Fork St. Maries River near mouth Gold Center Creek, Clarkia. Idaho. Shoshone County T. 42 N. R. 2 E., Sec. 11.	R. petiolare.	3,100	10	15			
	R. lacustre.	200	0	0	1,200	32	1923
West Fork Potlatch Creek 7.3 miles northeast of Bovill, Idaho on road to Clarkia, Idaho. Latah County T. 42 N., R. 1 E., Sec. 32.	R. petiolare.	51	1	25			
	R. inerme.	1	0	0			
	R. lacustre.	2	0	0	60	0	

Annual Report 1929
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B. Details of Pine Infection Centers.

Four new pine infection centers were found during the 1929 season. A detailed report of each follows:

1. Name: North Fork Reed's Creek Infection.

Location: $1\frac{3}{4}$ miles west of Headquarters, Idaho on North Fork Reed's Creek, township 38 north, range 5 east, section 16.

Inspectors: C. Chapman, E. L. Joy, H. N. Putnam. September 4, 1929.

Pine inspection: Scattered young pines are growing in the stream type between stands of mature pine. R. petiolare was abundant before eradication in 1929. A total of 500 trees was examined, 15 of which were infected with a total of 22 cankers. No cankers were fruiting in 1929, the infection having originated in 1927. The infected trees were removed at the request of officials of the Clearwater Timber Protective Association.

Ribes inspection: The eradication crews had worked this area a few days before this infection was found making the examination of Ribes difficult. No infection was found on either the sprayed bushes or those that were still succulent because of insufficient spray.

Remarks: This was the only pine infection found on the Clearwater Timber Protective Association holdings and the only one of 1927 origin located in northern Idaho.

2. Name: Deep Creek-Elk Creek Infection.

Location: At the junction of Deep and Elk creeks 3 miles south of Elk River, Idaho, township 39 north, range 2 east, section 11.

Inspectors: E. L. Joy, R. K. Pierson, H. N. Putnam, F. F. Staat, F. Joy and C. M Chapman. July 6, 1929.

Pine inspection: A scattered stand of young pines is growing along the streams on a dry rocky site. About 500 pines were examined and 5 found infected with one canker each, 3 of 1923 and 2 of 1927 origin. The infected trees are scattered along both streams for a total of 1/2 mile. Infection in this area originated in 1923.

Ribes inspection: Heavy Ribes infection was found in this vicinity in 1928 but no infected pines could be located. Heavy Ribes infection was again found in 1929. Four species on this area, R. petiolare, R. irriguum, R. viscosissimum and R. lacustre were all infected.

Remarks: No explanation can be given as to why this infection did not intensify more during the 1927 wave of infection. Ribes occur in abundance and pines grow in close association. The Ribes were eradicated from this area in 1929.

3. Name: Long Meadow Creek Infection.

Location: On Long Meadow Creek and 3 Bear Creek at the mouth of 3 Bear Creek 7 miles southwest of Elk River, Idaho; 6 miles due west of the Deep Creek-Elk Creek infection, township 39 north, range 1 east, section 14.

Inspectors: C. M. Chapman, R. K. Pierson, E. L. Joy, H. N. Putnam and crew. August 21, 1929.

Pine inspection: A dense stand of 20-40-year old white pine is growing on the slope west of Long Meadow Creek and along both slopes in the 3 Bear Creek drainage. The slope east of Long Meadow Creek is rocky and dry with only scattered trees on it.

A very large pine infection area was found here probably of 1923 origin. Many fruiting cankers of 1923 and 1926 origin and a heavy crop of 1927 cankers were found. It is estimated that the infected area is about 60 acres in extent and that there are approximately 4,500 infected trees.

Ribes inspection: R. lacustre and R. viscosissimum were the only species found on this area or in the immediate vicinity and 98½ per cent of these were R. lacustre. Both species were infected and showed a considerable amount of intensification. The telia produced on R. lacustre were exceptionally well developed for this species.

Remarks: The two streams flow through a rocky canyon. Apparently this is an area of high humidity during the summer.

Eradication of the Ribes was in progress when the infection was found. 300 acres of timbered land around the infection were eradicated of Ribes to check the intensification of the disease on the pines.

4. Name: St. Maries River Infection.

Location: Above Clarkia, Idaho along the St. Maries River, township 42 north, range 2 east, sections 8, 9, 10, 11.

Inspectors: F. Joy, R. Joy, R. E. Myers, O. Luke. September 3, 1929.

Pine Inspection: A dense stand of 20-40-year old white pine borders the river and its tributaries in this region. Infection was found on pines for a distance of 1½ miles along the river. This infection is of 1923 origin with a heavy wave of 1927 cankers showing. Only one fruiting canker was found.

Ribes inspection: The stream-type in this region is wide with heavy concentrations of R. peticlare in it. This affords an excellent chance for intensification of the disease. Many of these bushes were found to be infected. R. lacustre, also abundant in the stream type, was not infected.

3. Name: Long Meadow Creek Infection.

Location: On Long Meadow Creek and [illegible] Bear Creek at the mouth of 3 Bear Creek 7 miles southwest of Elk River, Idaho; [illegible] miles east of the Deep Creek-Elk Creek infection, township [illegible] north, range [illegible], section 14.

Inspectors: C. A. Chapman, [illegible], [illegible] Putnam and crew. August 21, [illegible].

Pine Inspection: A dense stand of [illegible]-40-year old white pine is growing on the slope west of Long Meadow Creek and along both slopes in the 3 Bear Creek drainage. The slope east of Long Meadow Creek is rocky and dry with only scattered trees on it.

A very large pine infection area was found here probably of [illegible] origin. Many fruiting cankers of [illegible] and 1926 origin and a heavy crop of 1927 cankers were found. It is estimated that the infected area is about 60 acres in extent and that there are approximately [illegible] infected trees.

Ribes Inspection: R. lacustre and R. viscosissimum were the only species found on this area or in the immediate vicinity and [illegible] per cent of these were R. lacustre. Both species were infected and showed a considerable amount of intensification. The aecia produced on R. lacustre were exceptionally well developed for this species.

Remarks: The two streams flow through a rocky canyon. Apparently this is an area of high humidity during the summer.

Eradication of the Ribes was in progress when the infection was found. 300 acres of [illegible] land around the infection were eradicated of Ribes to check the intensification of the disease to the pines.

4. Name: St. Maries River Infection.

Location: Above Clarkia, Idaho along the St. Maries River, township 42 north, range 2 east, sections 3, 9, 10, 11.

Inspectors: F. Joy, [illegible], L. N. Myers, [illegible]. Date. September [illegible].

Pine Inspection: A dense stand of 20-[illegible]-year old white pine borders the river and its tributaries in this region. Infection was found on pines for a distance of 1½ miles along the river. This infection is of 1923 origin with a heavy wave of 1927 cankers showing. Only one fruiting canker was found.

Ribes Inspection: The stream-type in this region is wide with heavy concentrations of R. petiolare in it. This affords an excellent chance for intensification of the disease. Many of these bushes were found to be infected. R. lacustre, also abundant in the stream type, was not infected.

Remarks: Scouting on pines was done in this drainage in May, 1929 but no cankers could be located. This bears out other scouting observations which have shown that young cankers are very obscure in the early spring.

An analysis of the existing conditions on these four areas is shown in the following table:

TABLE NO. 3

RIBES ABUNDANCE AND PINE CANKERS AT INFECTION CENTERS

Area	Ribes Abundance: Light, Medium, Heavy					Cankers Originating	
	R. pet.	R. iner.	R. irrig.	R. vis.	R. lac.	In 1923	Since 1923
N. Fork Reed's Creek	H	0	0	0	M	0	22
Deep Creek-Elk Cr.	M	0	L	L	L	3	2
Long Meadow Creek	0	0	0	L	L	5	123
St. Maries River	H	M	0	0	L	1	93

C. Discussion.

Of the 39 inspections in northern Idaho 34 were in the regions which form the southern part of the commercial-white-pine belt. An abundance of R. petiolare is found in association with white pines in this region making the blister-rust hazard extremely great. The probability of establishment of the disease on this very susceptible Ribes species and associated pines is high and the possible damage resulting from this infection great. Therefore control of the disease in this region by stream-type eradication is of immediate importance and the locating of all infection centers necessary in planning this control.

16 infection centers were located on 9 major drainages in this region. These are scattered over the southern edge of the white-pine belt and in all cases are in or adjacent to excellent stands of white pine. Pine infection was found on 4 of these drainages and in all probability is established on every large drainage in this region.

Remarks: Scouting on pines was done in this drainage in May, 1929 but no cankers could be located. This casts out other scouting observations which have shown that young cankers are very obscure in the early spring.

An analysis of the existing conditions on these four areas is shown in the following table:

TABLE NO. 3

RIBES ABUNDANCE AND PINE CANKERS IN INFECTION CENTERS

Cankers Originating		Ribes abundance; Light, Medium, Heavy					Area
since 1922	In 1929	S.c.c.	R.vis.	R.inerm.	R.irr.	R.pet.	
[illegible]	0	M	0	0	0	H	N. Fork Reed's Creek
1	3	L	L	L	0	L	Deep Creek-Elk Cr.
100	[illegible]	L	L	0	0	0	Long Meadow Creek
[illegible]	1	L	0	0	H	H	St. Maries River

C. Discussion.

Of the 39 infections in northern Idaho 34 were in the region which form the southern part of the commercial-white-pine belt. An abundance of R. petiolare is found in association with white pine in this region making the blister-rust hazard extremely great. The probability of establishment of the disease on this very susceptible Ribes species and associated pines is high and the possible damage resulting from this infection great. Therefore control of the disease in this region by stream-type eradication is of immediate importance and the locating of all infection centers necessary in planning this control.

16 infection centers were located on 9 major drainages in this region. These are scattered over the southern edge of the white-pine belt and in all cases are in or adjacent to excellent stands of white pine. Pine infection was found on 4 of these drainages and in all probability is established on every large drainage in this region.

The 5 inspections made on the Kaniksu National Forest, where *R. inerme* is the susceptible species in abundance, did not reveal any infection. Infection had been found in this region both in 1927 and 1928.

COSTS

The following table shows the cost of this project in 1929.

TABLE NO. 4

COST OF PROJECT 4.12,
SCOUTING IN IDAHO, 1929

Item	Cost	Per Cent Total
Salaries	$1,120.50	68.79
Subsistence	278.99	17.13
Personal Auto	212.59	13.05
Other Travel	13.64	.84
Miscellaneous	3.05	.19
Total	$1,628.77	100.00

CONCLUSION

Although scouting in northern Idaho in 1929 was not as extensive as in 1928, the work was done in the region where heavy infection was found in 1928 and where conditions are extremely favorable for the establishment and spread of the disease. Here, also, are very valuable stands of white pine in which most of the eradication work is being done and because of this a disease survey is necessary.

The disease was found widely distributed over the southern portion of the white-pine belt and pine infections located indicate that the disease is well established in this area. Its size and inaccessibility make it impossible to scout intensively a very large per cent of the region.

BLISTER-RUST-CONTROL WORK IN WASHINGTON
1929

Blister-rust-control work in Washington was carried on, as in the past, as a cooperative project between the Washington State Department of Agriculture and the Bureau of Plant Industry. The basic memorandum of understanding upon which this work was organized was made effective July 1, 1927 and can be found in the report for that calendar year. The following is the amendment to this memorandum to cover the work as organized for the Federal fiscal year 1930, beginning July 1, 1929:

AMENDMENT TO
MEMORANDUM OF UNDERSTANDING
Effective July 1, 1927

Between
THE UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY
and the
WASHINGTON STATE DEPARTMENT OF AGRICULTURE

Cooperative Work in Controlling White Pine Blister Rust in
WASHINGTON
* * * * *

Paragraph C-6, of the Memorandum of Understanding described above contains the following:

"For the Fiscal Year 1928, the Bureau of Plant Industry shall contribute in value approximately $13,000 to the support of this cooperative work, and the Washington State Department of Agriculture shall contribute in value approximately $8,000; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence."

In accordance with the foregoing provision, it is mutually agreed that for the fiscal year ending June 30, 1930 there will be contributed in value by the Washington State Department of Agriculture approximately $8,000, and by the United States Department of Agriculture Bureau of Plant Industry, thru its Office of Blister Rust Control approximately $10,800 in connection with cooperative blister-rust control work in Washington.

Date:	Signature:
8/8/29	(s) Erle J. Barnes Director, Washington State Dept. of Agriculture
8/19/29	(s) Wm. A. Taylor Chief, Bureau of Plant Industry

BLISTER-RUST-CONTROL WORK IN WASHINGTON
1929

Blister-rust-control work in Washington was carried on, as in the past, as a cooperative project between the Washington State Department of Agriculture and the Bureau of Plant Industry. The basic memorandum of understanding upon which this work was organized was made effective July 1, 1927 and can be found in the report for that calendar year. The following is the amendment to this memorandum to cover the work as organized for the Federal fiscal year 1930, beginning July 1, 1929:

AMENDMENT TO
MEMORANDUM OF UNDERSTANDING
Effective July 1, 1927

Between
THE UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY
and the
WASHINGTON STATE DEPARTMENT OF AGRICULTURE

Cooperative Work in Controlling White Pine Blister Rust in
WASHINGTON

* * * * *

Paragraph C-6, of the Memorandum of Understanding described above contains the following:

> "For the Fiscal Year 1928, the Bureau of Plant Industry shall contribute in value approximately $12,000 to the support of this cooperative work, and the Washington State Department of Agriculture shall contribute in value approximately $8,000; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence."

In accordance with the foregoing provision, it is mutually agreed that for the fiscal year ending June 30, 1930 there will be contributed in value by the Washington State Department of Agriculture approximately $8,000, and by the United States Department of Agriculture Bureau of Plant Industry, thru its Office of Blister Rust Control approximately $10,800 in connection with cooperative blister-rust control work in Washington.

Signature:	Date:
(s) Erle J. Barnes Director, Washington State Dept. of Agriculture	9/3/29
(s) Wm. A. Taylor Chief, Bureau of Plant Industry	8/19/29

SCOUTING FOR BLISTER RUST IN WASHINGTON, 1929

By
E. L. Joy,
Junior Forester.

INTRODUCTION

Blister rust was first found in Washington near Mt. Vernon in 1921. Since this discovery the disease has been found throughout the Cascade and Olympic Mountains of Washington and in the northeast part of the state, a region adjacent to the Inland Empire white-pine belt. Because the disease is so widespread in the western part of the state, no scouting was done there.

PURPOSE

The purpose of this scouting was to determine the extent and intensity of the disease.

LOCATION OF WORK

All 1929 scouting was done in the northeast part of the state in Pend Oreille County. This region is west of and adjacent to the Pend Oreille River.

PERSONNEL

A three-day trip was made through this region and scouting done by H. N. Putnam, F. F. Staat and R. K. Pierson.

RESULTS

A total of 11 inspections was made in this region. At none of these points was infection found on either host. The following is an account of the number of Ribes and pines examined:

Ribes inerme - -	216
R. viscosissimum -	797
R. lacustre - -	295
White pines - - -	508

COSTS

An analysis of the costs of this project is shown in the following table:

SCOUTING FOR BLISTER RUST IN WASHINGTON, 1930

By
W. [illegible]. Joy,
Junior Forester.

INTRODUCTION

Blister rust was first found in Washington near Mt. Vernon in 1921. Since this discovery the disease has been found throughout the Cascade and Olympic Mountains of Washington and in the northeast part of the state, a region adjacent to the Inland Empire white pine belt. Because the disease is so widespread in the western part of the state, no scouting was done there.

PURPOSE

The purpose of this scouting was to determine the extent and intensity of the disease.

LOCATION OF WORK

All 1930 scouting was done in the northeast part of the state in Pend Oreille County. This region is west of and adjacent to the Pend Oreille River.

PERSONNEL

A three-day trip was made through this region and scouting done by R. [illegible]. Putnam, R. F. Stuart and P. K. [illegible].

RESULTS

A total of 11 inspections was made in this region. At none of these points was infection found on either host. The following is the account of the number of Ribes and pines examined:

Ribes inerme - - [illegible]
R. viscosissimum - [illegible]
R. lacustre - - 255
White pines - - - [illegible]

COSTS

An analysis of the costs of this project is shown in the following table:

TABLE NO. 1.

COSTS OF SCOUTING IN WASHINGTON - 1929

Item	Amount	Per Cent
Salaries	$330.89	89.94
Subsistence	16.30	4.43
Transportation	20.29	5.51
Miscellaneous	.42	.12
Total	$367.90	100.00

BLISTER-RUST-CONTROL WORK IN OREGON
1929

Blister-rust-control work in Oregon was carried on, as in the past, as a cooperative project between the Oregon State Board of Horticulture, Oregon State Board of Forestry, Oregon State College and the Bureau of Plant Industry. The basic memorandum of understanding upon which this work was organized was made effective July 1, 1927 and can be found in the report for that calendar year. The following is the amendment to this memorandum to cover the work as organized for the Federal fiscal year 1930, beginning July 1, 1929:

AMENDMENT TO
MEMORANDUM OF UNDERSTANDING
Effective July 1, 1927

Between
THE UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY
and the
OREGON STATE BOARD OF HORTICULTURE - - - OREGON STATE BOARD OF FORESTRY - - - and the OREGON STATE COLLEGE

Cooperative Work in Controlling White Pine Blister Rust in OREGON

* * *

Paragraph E-6 of the Memorandum of Understanding described above contains the following:

> "For the Fiscal Year 1928, the Bureau of Plant Industry shall contribute in value approximately $16,000 to the support of the cooperative work, and the Oregon State Board of Horticulture approximately $14,250, the Oregon State Board of Forestry approximately $7,000, and the Oregon Agricultural College shall contribute in value approximately $1,500; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence."

In accordance with the foregoing provision, it is mutually agreed that for the fiscal year ending June 30, 1930 there will be contributed in value by the Oregon State Board of Horticulture approximately $7,000, by the Oregon State Board of Forestry approximately $7,000, by the Botany Department of the Oregon State College approximately $1,000, by the School of Forestry of the Oregon State College approximately $250, by the Extension Service of the Oregon State College approximately $500, and by the United States Department of Agriculture, Bureau of Plant

BLISTER-RUST CONTROL WORK IN OREGON
1929

Blister-rust-control work in Oregon was carried on, as in the past, as a cooperative project between the Oregon State Board of Horticulture, Oregon State Board of Forestry, Oregon State College and the Bureau of Plant Industry. The basic memorandum of understanding upon which this work was organized was made effective July 1, 1927 and can be found in the report for that calendar year. The following is the amendment to this memorandum to cover the work as organized for the Federal fiscal year 1930, beginning July 1, 1929:

AMENDMENT TO
MEMORANDUM OF UNDERSTANDING
Effective July 1, 1927

Between
THE UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY
and the
OREGON STATE BOARD OF HORTICULTURE - - - OREGON STATE BOARD OF FORESTRY - - - and the OREGON STATE COLLEGE

Cooperative Work in Controlling White Pine Blister Rust in OREGON

* * *

Paragraph E-5 of the Memorandum of Understanding described above contains the following:

"For the Fiscal Year 1928, the Bureau of Plant Industry shall contribute in value approximately $16,000 to the support of the cooperative work, and the Oregon State Board of Horticulture approximately $14,250, the Oregon State Board of Forestry approximately $7,000, and the Oregon Agricultural College shall contribute in value approximately $1,500; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence."

In accordance with the foregoing provision, it is mutually agreed that for the fiscal year ending June 30, 1930 there will be contributed in value by the Oregon State Board of Horticulture approximately $7,000, by the Oregon State Board of Forestry approximately $7,100, by the Botany Department of the Oregon State College approximately $1,000, by the School of Forestry of the Oregon State College approximately $950, by the Extension Service of the Oregon State College approximately $500, and by the United States Department of Agriculture, Bureau of Plant

Industry, through its Office of Blister Rust Control, approximately $9,500 in connection with cooperative blister rust control work in Oregon.

Date:	Signature:
	(s) T. A. Sammis Jr. President, Oregon State Board of Horticulture
	(s) F. A. Elliott State Forester, Oregon State Board of Forestry
	(s) H. P. Barss Plant Pathologist, Oregon State College
	(s) Geo. W. Peavy Dean, School of Forestry
	(s) Paul V. Maris Director of Extension Service
12/13/29	(s) Wm. A. Taylor Chief, Bureau of Plant Industry

BLISTER RUST CONTROL WORK IN OREGON, 1929
By
L. N. Goodding,
Associate Pathologist.

THE WIND RIVER NURSERY

It was thought best to do re-eradication work at the Wind River Nursery as no adequate recheck had been made of the work done in 1928 and it was considered to be certain that some Ribes bracteosum had been missed and that some had sprouted from crowns and fallen stems. With this in mind, Mr. Lyle and Mr. Hinckley were assigned to the work with instructions to go over carefully as much of the stream type as possible before July 1, 1929, paying special attention to sections which had yielded much R. bracteosum in 1928. They were on the ground from June 16 to 28.

The recheck showed less misses and sprouting than were to be expected in stream type of the character worked. All our experience with R. bracteosum has taught us that crowns and layers hold tenaciously to life. In an ordinary situation where general protection is what is desired, further work should be unnecessary for several years.

The figures in the table do not show the true situation unless it is remembered that the major portion of the recheck was confined to the areas where Ribes were found to be abundant last year.

TABLE NO. 1.

RESULTS OF RE-ERADICATION - WIND RIVER NURSERY, 1929.

Species	1928 No. Bushes	1928 Feet Live Stem	1929 No. Bushes	1929 Feet Live Stem	Per Cent of 1928 Bushes	Per Cent of 1928 Feet Live Stem
R. bracteosum	6,058	40,778	345	5,747	5.8	1.1

To base the comparison on an acreage basis is obviously erroneous as an attempt was made to cover the entire area by scouts or crew in 1928, whereas very little attention was paid to anything but stream type in 1929. While the per cent of bushes eradicated in 1929 to those eradicated in 1928 is rather high, the per cent of live stem is low. The reason for this is obvious.

An analysis of the results of the recheck shows that of the total bushes eradicated 73 were seedlings, 146 others were six inches or less in height, another 102 were one foot or less in height and 33 were over 1.5 feet in height. 13 very evidently came from old crowns or fallen stems which had sprouted.

Seedlings are bound to be a continued source of annoyance as the fruit will be constantly supplied from higher levels by natural work.

No adequate work was done on a recheck of R. sanguineum. Only one bush was encountered within the 1,500-ft. zone, but it was a fair sized bush. Next year there are bound to be a good many seedlings in evidence on land where road building and snag falling has disturbed the soil. The land for the most part, however, is rapidly growing up to brush which will suppress much of the Ribes growth in the future.

Recommendations

Lyle's recommendation follows: "I suggest that a recheck for R. sanguineum be made within the 1,500-ft. radius by two men during flowering season, allowing about three days for the work, and that a crew of four men who have had previous experience in eradication take about six days to recheck the stream type again during the early summer of 1931, preferably, or of 1930. This should complete the eradication for a considerable period of time. There will, however, always be a fairly rapid reseeding from plants on streams above and outside the eradication zone. In using a crew of four men to recheck, it would be desirable for them all to work together on the area along Martha Creek as far as the water inlet for the nursery and along Trout Creek (especially above the bridge where the stream type widens out over a considerable area), and then to form two two-men crews in working the side streams to Martha and Trout Creeks."

Before further work on the nursery is done I think we should have the attitude of the Plant Quarantine and Administration Board in regard to shipping seedling pines planted after the nursery was placed in a sanitary condition. The Arboretum in itself does not seem to me to warrant the expenditure of the money necessary to protect it alone. If, however, the nursery can supply what is likely to be a growing demand for white-pine seedlings, the very moderate expense is justifiable.

If the R. bracteosum could be cleared out to the head of the streams on the Martha Creek side, the maintenance cost would be much less. Such a program on the Trout Creek side is out of the question as the tributaries are too distant and cover too much territory.

An analysis of the results of the recheck shows that of the total bushes eradicated [illegible] were seedlings, 146 others were 12 inches or less in height, another 104 were one foot or less in height and 53 were over 1.5 feet in height. [illegible] evidently came from old crowns or fallen stems which had sprouted.

Seedlings are bound to be a continued source of annoyance as the fruit will be constantly supplied from higher levels by [illegible] work.

No adequate work was done on a recheck of R. glandulosum. Only one bush was encountered within the 1,500-ft. zone, but it was a fair sized bush. Next year there are bound to be a good many seedlings in evidence on land where road building and snag falling has disturbed the soil. The land for the most part, however, is rapidly growing up to brush which will suppress much of the Ribes growth in the future.

Recommendations

Lyle's recommendation follows: "I suggest that a recheck for R. sanguineum be made within the 1,500-ft. radius by two men during the flowering season, allowing about three days for the work, and that a crew of four men who have had previous experience in eradication take about six days to recheck the stream type [illegible] of 1931, preferably, or of 1930. This should complete the eradication for a considerable period of time. There will, however, always be a fairly rapid reseeding from plants on streams above the limits of the eradication zone. In using a crew of four men to recheck, it would be desirable for them all to work together on the area along Martha Creek as far as the water inlet for the nursery and along Trout Creek (especially above the bridge where the stream type widens out over a considerable area), and then to form two two-men crews in working the side streams to Martha and Trout Creeks."

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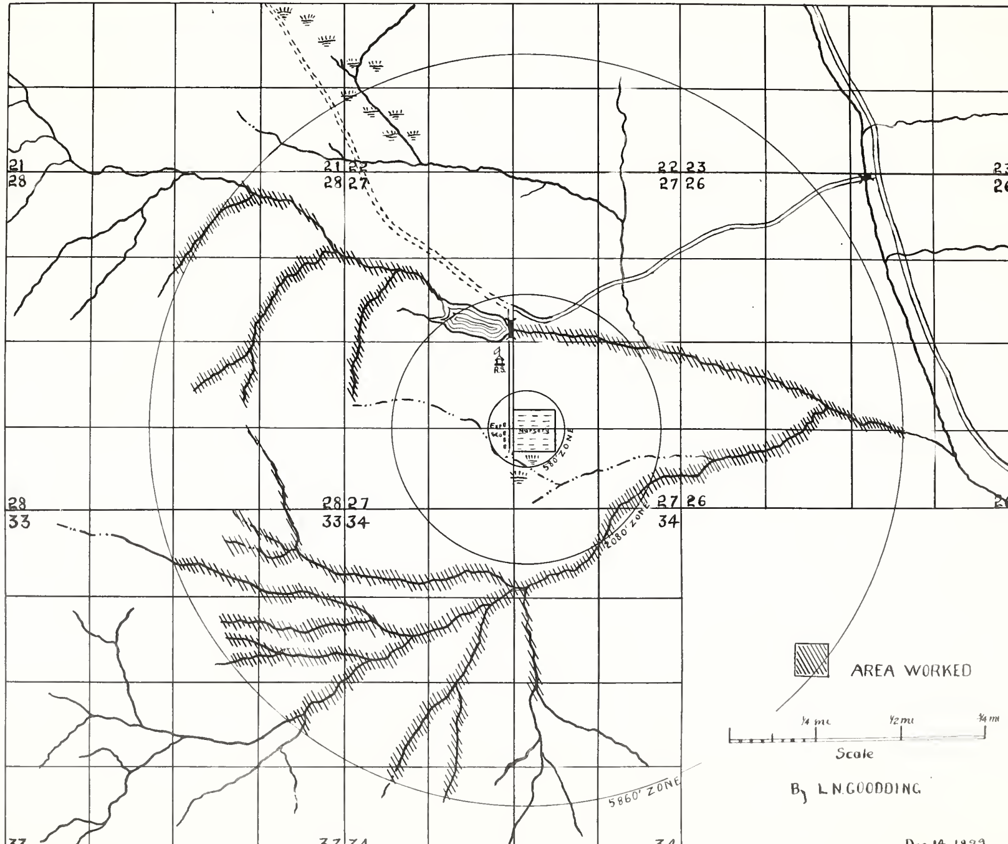
T 4 N - R 7 E WILLAMETTE MERIDIAN



WIND RIVER EXPERIMENT STATION AREA

NURSERY SANITATION

Peavy Arboretum

By request of Dean Geo. W. Peavy of the School of Forestry of the Oregon State College, the Office of Blister-Rust Control undertook to put the Peavy Arboretum and Nursery in a sanitary condition so that white and sugar pines might be grown for possible distribution and for arboretum purposes. The nursery itself is small. At the time Ribes eradication work was started there were about five acres under cultivation. Only about half of this was in nursery stock, and no five-needled pines had been planted. In the Arboretum, however, western white pines had been planted in several places.

A preliminary survey of the grounds was made by McDaniels, nurseryman at the Peavy Arboretum, and L. N. Goodding, while R. sanguineum, the major species on the grounds, was in blossom. The streams were carefully scouted but no R. bracteosum was found. There was revealed, however, considerable R. lacustre and R. divaricatum. It was thought best to do a part of the eradication work while R. sanguineum was in blossom and for that reason a crew of students was put on the ground May 4 and an excellent showing was made. Further attempt to do work before school closed was a failure owing to the press of class work at that time.

No attempt has been made to classify the land into different types. The streams were worked in conjunction with the rest of the land. Practically all the area covered can be classed as open brush type, though a small part is timbered. The timbered portion is about as brushy as the more open land. All of the land east of the highway is an open field and the only work required was a cruise of the stream.

While the situation seemed to present no difficulties, one of great importance was encountered. Poison ivy is so abundant that in spite of all precautions all those who worked for two or more days were attacked and in two cases the poisoning was severe.

A glance at the map will reveal the location of the arboretum, the nursery and the areas eradicated.

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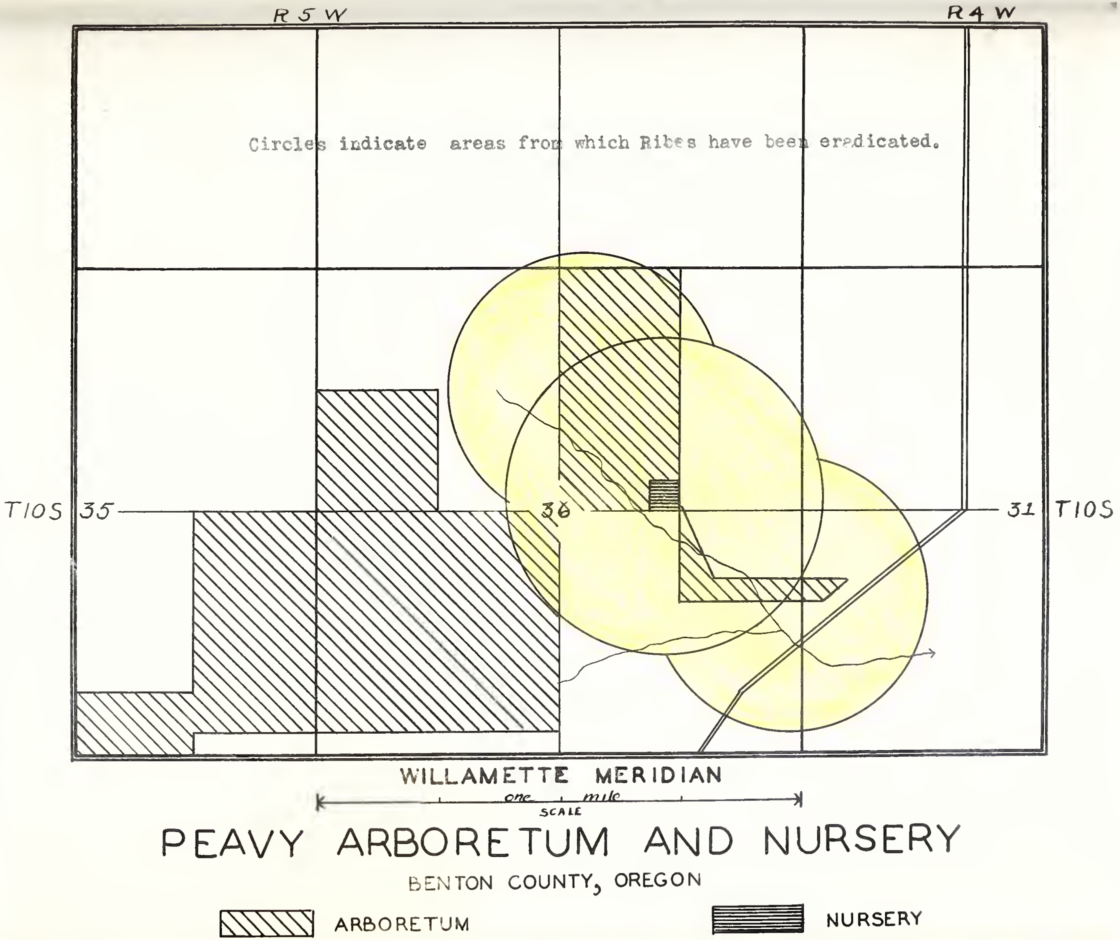

PEAVY ARBORETUM AND NURSERY

BENTON COUNTY, OREGON

L.N. GOODDING ~ Dec. 15, 1929

TABLE NO. 2.

PEAVY ARBORETUM AND NURSERY

Ribes Eradicated		
Species	No. Bushes	Feet Live Stem
R. sanguineum	1,362	42,943
R. lacustre	65	620
R. divaricatum	234	9,117
Totals	1,661	52,680

Acres covered 396
Ribes per acre. 4.2
Live stem per acre. . . . . 136 ft.

Labor . . . . 37 man days
Acres per man day 10.7
Bushes per man per day. 45
Live stem per man per day . . . . . . 1,532 ft.

Work Needed in the Future

It is planned to go over the ground next spring when the *R. sanguineum* is in blossom. This will be done by students of the School of Forestry under direction of the Blister-Rust Office.

ERADICATION IN THE STILL CREEK AREA, 1929

The Ribes eradication work was resumed in the Still Creek area June 28. Most of the work had been completed north of the main stream, but an area of considerable extent remained south of it. This represented some difficult territory with stream type of a swampy nature with an abundance of Ribes. Most of the work was hand eradication, the chemical work being on an experimental basis. A small area consisting mostly of *R. lacustre*, with some *R. bracteosum*, was chemically eradicated at the close of the season.

The total acreage for the season was 460, of which 37.6 acres were stream type and the remainder open-reproduction type. Of the 37.6 acres of stream type, 5.6 acres were chemically eradicated. As the stream type, except for that chemically eradicated, was worked in conjunction with the open-reproduction type no comparative study of costs on the two types can readily be made.

The chemical eradication was a very expensive piece of work. The Ribes per acre will indicate that they were heavily concentrated. The plot was well up on the side of a mountain and chemicals had to be carried long distances, mostly by back-packing.

Computing the man-days by a comparison of the Ribes in stream and open-reproduction types we find that approximately 77 man-days were expended on the open-reproduction type. 422 acres were covered, or 5.5 acres per man-day. 198 man-days were expended on the stream type, exclusive of the portion chemically eradicated, or .19 acres per man-day. 35 man-days were used on the chemical eradication, or .16 acres per man-day.

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The total acreage for the season was 460, of which 57.0 acres were stream type and the remainder open-reproduction type. Of the 57.0 acres of stream type, 3.6 acres were chemically eradicated. As the stream type, except for that chemically eradicated, was worked in conjunction with the open-reproduction type no comparative study of costs on the two types can readily be made.

The chemical eradication was a very expensive piece of work. The Ribes per acre will indicate that they were heavily concentrated. The plot was well up on the side of a mountain and chemicals had to be carried long distances, mostly by back-packing.

Computing the man-days by a comparison of the Ribes on stream and open-reproduction types we find that approximately 77 man-days were expended on the open-reproduction type. 402 acres were covered, or 5.5 acres per man-day. 138 man-days were expended on the stream type, exclusive of the portion chemically eradicated, or .19 acres per man-day. 23 man-days were used on the chemical eradication, or .16 acres per man-day.

TABLE NO. 3.

NUMBER BUSHES AND FEET LIVE STEM PER ACRE, STILL CREEK, 1929.

Hand Eradication

Type	Acres	R. lac.		R. sang.		R. brac.		R. visco.		Total	
		Bushes	Feet L.S.	Bushes	Feet L.S.	Bushes	Feet L.S.	Bushes	Feet L.S.	Bushes	Feet L.S.
Open reproduction	422.4			2.6	191.8			1.9	98.1	4.5	289.9
Stream	32.0	119.0	4,083			13.6	595			132.6	4,678.0
Total	454.4	119.0	4,083	2.6	191.8	13.6	595	1.9	98.1	137.1	4,967.9
Chemical Eradication											
Stream	5.6	260.0	29,946			38.6	4,010			298.6	33,956
Total	5.6	260.0	29,946			38.6	4,010			298.6	33,956

Totals All Species

Type	Acres	Bushes	Ft. L.S.
Open reproduction	422.4	4.5	289.9
Stream	37.6	431.2	38,634.0
Totals	460.0	435.7	38,923.9

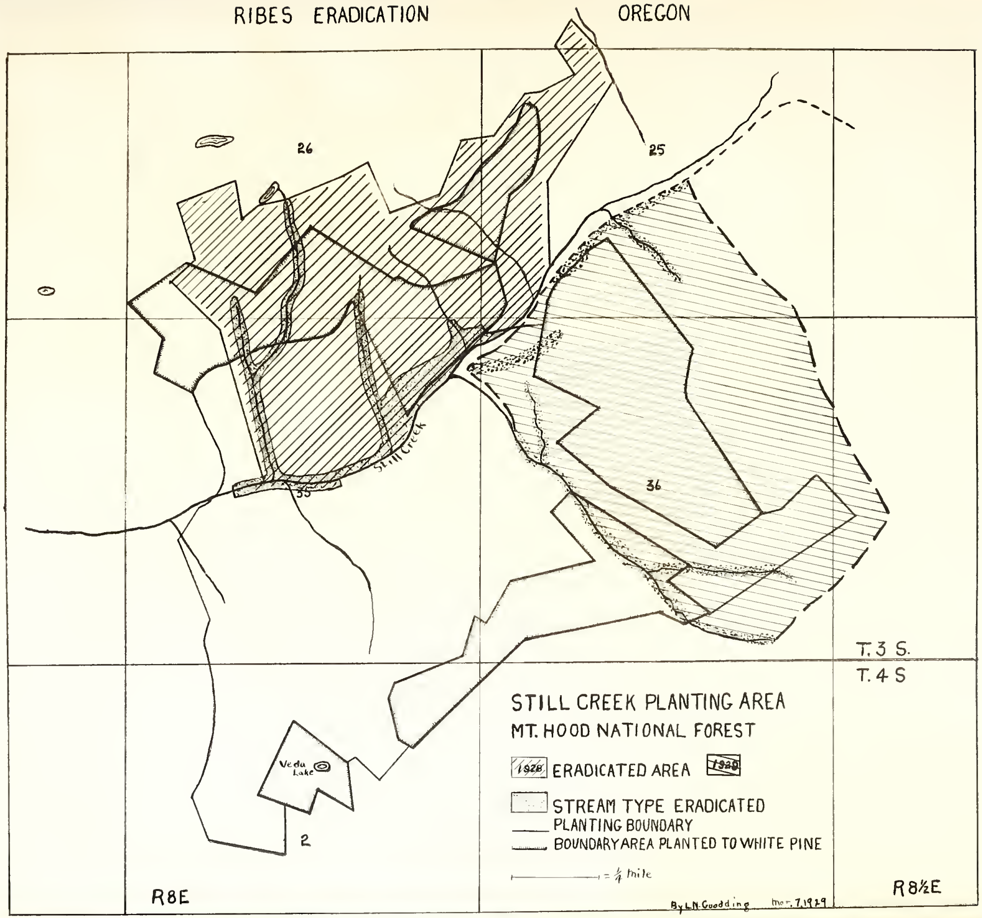
TABLE NO. 4.

ACTUAL FIELD COST OF STILL CREEK ERADICATION.

I t e m		C o s t
Salaries	Temporary men	$1,306.06
Subsistence	Salary of cook	280.00
	Cost of food	379.65
	Transp. of food	15.00
Transportation of men		42.00
Total		$2,022.71

Average cost per acre.............. $4.40
Cost per acre, open reproduction type $1.19
Cost per acre, stream type hand eradication $34.20
Cost per acre, stream type chemical eradication...................... $41.81

Cost of eradication per acre based on number of man-days labor, expense at camp, including transportation to and from camp, and meal expense. This was derived from the above cost account, an account to include only the expenses for men actually working in camp. There was practically no new equipment purchased for the fiscal year 1929.


RIBES ERADICATION
OREGON
26
25
35
36
Still Creek
Veda Lake
2
T. 3 S.
T. 4 S
R8E
R8½E
STILL CREEK PLANTING AREA
MT. HOOD NATIONAL FOREST
1928 ERADICATED AREA 1929
STREAM TYPE ERADICATED
PLANTING BOUNDARY
BOUNDARY AREA PLANTED TO WHITE PINE
= ¼ mile
By L.N. Goodding
Mar. 7, 1929

Recommendations

No adequate checking on the work on the Still Creek planting has been done. The streams will certainly need to be worked carefully, as much R. bracteosum and R. lacustre have, without doubt, sprouted from fragments of crowns and fallen stems. There are also abundant seedlings in places but most of these are still too small to be readily detected. It is a question whether the planted area near Veda Lake should be worked. The Ribes are very concentrated and the area of pines is hardly extensive enough to pay for the work. A portion of the area, however, has been eradicated in connection with the chemical eradication experiments.

Down stream from the area eradicated during the summer of 1929, on the south side of Still Creek, is a small area varying from a rod to several rods in width and perhaps 15 chains long which should be eradicated if possible next summer to round out the Still Creek job and insure a fair degree of protection to pines.

By reference to the map on page 218 of the 1928 report it will be seen that an area of white pine of considerable extent occurs south of Still Creek, well up on the slope. Much of this represents land that can be worked by scouts, but there are several places where swamps with abundant R. lacustre occur. This should be worked to round out the eradication job.

In order to make the chemical eradication performed in 1929 effective, it would seem best to go over the areas as early in the season as possible and respray where sprouting has occurred.

EDUCATIONAL AND OFFICE WORK

As part of the normal duties of the state leader in Oregon, a considerable amount of work is done at the Corvallis office in receiving and sending out communications and circularizing the personnel of various cooperating organizations. Numerous requests for information regarding white-pine blister rust, the methods for its control and the status of the work in Oregon are received and answered. During 1929, 315 communications were received at the Corvallis office and 283 original letters were sent out. Two circular letters were also prepared and mimeographed and sent to Forest Service officials and state fire wardens. These two form letters, 647 of which were sent out, are shown on the two following pages.

As a secondary activity of the state leader, a trip was made on August 22 to Gunter, Oregon in company with Mr. J. O. Holt of the

Eugene Fruit Growers' Association, to investigate the reported occurrence of chestnut blight at that place. This work was done at the request of Doctor Haven Metcalf of the Office of Forest Pathology. Several chestnut trees were found at this place which were infected with the chestnut blight. A careful examination of the native chinquapin in the vicinity of Gunter failed to reveal the presence of the disease upon these shrubs.

SAMPLE

UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Plant Industry
In Cooperation with
THE OREGON STATE BOARD OF FORESTRY

Office of Blister Rust Control
Oregon State College
Corvallis, Oregon
February, 1929

Blister-Rust Control

Dear Sir:

I am sending you a list of the places where blister rust was found in Oregon last fall. You will notice by this that it made a sweeping advance during 1928. I wish to call your attention to a few points which seem to me to be significant.

First, blister rust is firmly established on white pines in Oregon in a region where its extermination is impossible.

Second, blister rust is established in several places where its intensification will result in a rapid advance of the disease toward the sugar pines of southern Oregon and California.

Third, while no rust has been found on pines in the Wilson River region west of Gales Creek, the intensification of the rust on currants in that and adjoining sections indicates that there are diseased pines in that territory which were scattering spores during 1928.

Fourth, the rust was found east of the Cascades, and on both the east and west slopesit is dangerously near the sugar pine limits. Sugar pine, as you doubtless know, extends to the Breitenbush on the west slope, and to White Water Creek north of the Metolius east of the mountains.

Fifth, the rust is usually far ahead of the limits we are able to discover. If this is the case in Oregon, sugar pine will soon show the effects of blister rust attack within its native territory.

Blister rust is with us, with us to stay, and with us to do an enormous amount of damage within a very few years. There are many

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[illegible]

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Bureau of Plant Industry
In Cooperation with
THE OREGON STATE BOARD OF FORESTRY

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Oregon State College
Corvallis, Oregon
[illegible]

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Third, while no rust has been found on pines in the Wilson River region west of Dell's Creek, the intensification of the rust on currants in that and adjoining sections indicates that there are diseased pines in that territory which were scattering spores during 1928.

Fourth, the rust was found east of the Cascades, and on both the east and west slopes it is dangerously near the sugar pine limits. Sugar pine, as you doubtless know, extends to the Willamette on the west slope, and to White Water Creek north of the Metolius east of the mountains.

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Blister rust is with us, with us to stay, and with us to do an enormous amount of damage within a very few years. There are many

places in the Cascades where we can ill afford to lose our western white pines and certainly we cannot afford to lose our sugar pine.

Please watch for outbreaks of the disease next spring and study the blister rust situation. After we know where the rust is, something about the timber at stake, and something about our chances of saving it, perhaps there is something we can do.

Thanking you for your watchful eye, I am

Yours very truly,

(s) Leslie N. Goodding,
Associate Pathologist.

SAMPLE

UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Plant Industry
In Cooperation With
THE STATE BOARD OF FORESTRY

Blister-Rust Control

Office of Blister Rust Control
Botany Department, O.S.C.,
Corvallis, Oregon.
September 10, 1929.

The time is ripe to look for white pine blister rust. As the rains start and your work with fires begins to ease up, you may find time to examine currants or gooseberries in your immediate neighborhood for blister rust. This is the season when it is easiest to find. In case you see something you believe to be the rust, collect a specimen and send it to me, giving the locality, date collected and your name. Also, you may ask any questions you wish. If I cannot answer them, perhaps some one else at the college can.

Blister rust has been found on pines on a small creek near Palmer on Herman Creek, on Sandy River, on Zigzag River, on Camp Creek, on Still Creek and on Salmon River; all in the Mt. Hood National Forest. It is unquestionably present on pines in the Wilson River region in Tillamook County, though infection has not yet been located there. It is not unlikely that it is also established on pines in the Black Rock region in Polk County.

When you find infection on currants, note whether white pines are in the immediate vicinity, and include the notation in your letter

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Associate Pathologist.

<u>SAMPLE</u>

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Bureau of Plant Industry
In Cooperation With
THE STATE BOARD OF FORESTRY

Blister-Rust Control

Office of Blister Rust Control
Botany Department, O.S.C.,
Corvallis, Oregon.
September 10, 19[illegible].

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Many thanks for your help.

Yours very truly,

(s) Leslie N. Goodding,
Associate Pathologist.

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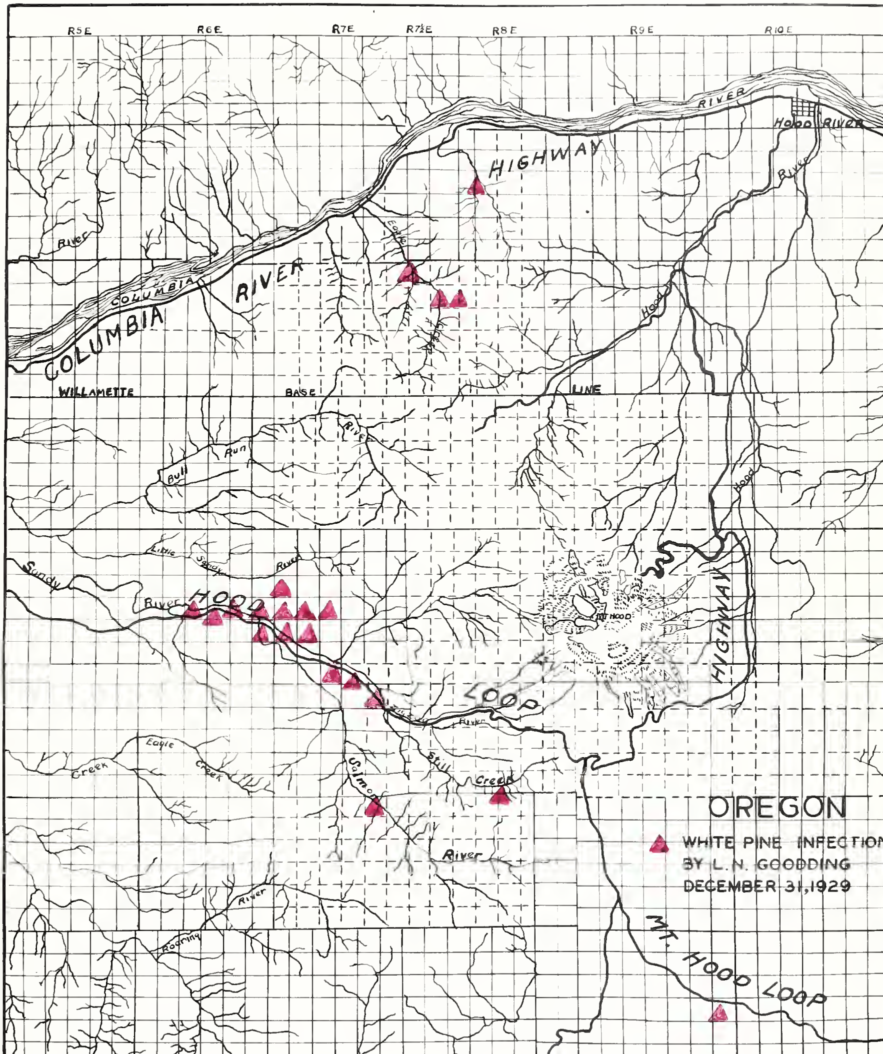

R5E
R6E
R7E
R7½E
R8E
R9E
R10E
COLUMBIA
COLUMBIA RIVER
RIVER
Hood River
HIGHWAY
Eagle
WILLAMETTE
BASE
LINE
Bull Run River
Little Sandy River
Sandy
River
HOOD
LOOP
MT HOOD
HIGHWAY
Hood
Eagle Creek
Salmon
Still Creek
River
Roaring River
MT. HOOD LOOP
OREGON
WHITE PINE INFECTION
BY L. N. GOODDING
DECEMBER 31, 1929


OREGON
WASHINGTON
IDAHO
CALIFORNIA
NEVADA
PACIFIC OCEAN
0 20 40 60 80
CLATSOP
COLUMBIA
TILLAMOOK
WASHINGTON
MULTNOMAH
HOOD RIVER
YAMHILL
CLACKAMAS
POLK
MARION
LINCOLN
BENTON
LINN
LANE
COOS
DOUGLAS
CURRY
JOSEPHINE
JACKSON
KLAMATH
LAKE
DESCHUTES
CROOK
JEFFERSON
WASCO
SHERMAN
GILLIAM
MORROW
WHEELER
GRANT
UMATILLA
UNION
WALLOWA
BAKER
HARNEY
MALHEUR
RIBES INFECTION AREA
1929
DATA BY L. N. GOODDING

SCOUTING TO DETERMINE BLISTER RUST SPREAD

Scouting for pine infection was started in the Mt. Hood region as soon as weather conditions permitted. The first infected trees were found on Herman Creek at a point near the Ribes infection point of last year. In this area there are but few white pines and many of these are remote from the stream. Near the stream, five infected trees were found; the most heavily diseased bore 57 cankers. An analysis of these showed 48 incipient cankers none of which had produced pycnia, 2 which had produced pycnia, 5 which had produced aecia once and 2 which had produced aecia twice. Five infections had entered 1923 wood, 3-1924 wood, 25-1925 wood, 22-1926 wood and 2-1927 wood. Infection apparently took place in 1925 and a very heavy intensification took place in 1927. A nearby tree about 25 feet in height had but one canker. This was apparently on 1923 wood, but had fruited two or possibly three times. As the canker was a large, old one, the infection may have entered on 1921 or 1922 wood and have been due to a 1923 infection.

Lyle found infection on Eagle Creek. Later this area was studied by Putnam and Goodding and data on it are included in the former's report. A much more careful study will need to be made to account for the ubiquitous nature of the infection. Infection seems to be general a considerable distance from the stream, and _R. sanguineum_ seems to be infrequent.

Lyle also found a single canker at the head of Beaver Creek. Ribes at this point are scarce and the infection appears to have been a chance catch. It is interesting in that it indicates that infection is likely to be established at several places east of the mountains where there are favorable associations of pines with _R. petiolare_.

Riley and Goodding spent much time scouting the headwaters of Salmon River and the Santiam River, but no pine infections were located and no Ribes infections in excellent association with pines.

One pine infection was found within the Still Creek planting, but not in the portion planted to white pine.

A special study of pine infections in the Rhododendron region was made by Putnam and his crew. Here the disease is wide-spread on the pines and in several places pines are already dying. At one point about two miles above Rhododendron, on Camp Creek, one tree has several hundred cankers.

Blister rust was found on Ribes over a greatly extended territory in spite of the fact that the dryness of the season was unfavorable for the spread and intensification of the disease. Northern Clatsop

SCOUTING TO DETERMINE BLISTER RUST SPREAD

Scouting for pine infection was started in the [illegible] as soon as weather conditions permitted. The first infected trees were found on [illegible] Creek at a point near the [illegible] infection point of last year. In this area there are but few white pine and many of these are remote from the stream. Near the stream, five infected trees were found; the most heavily diseased bore 57 cankers. An analysis of these showed 49 incipient cankers none of which had produced pycnia, 3 which had produced pycnia, 3 which had produced aecia once and 2 which produced aecia twice. Five infections had entered [illegible] wood, [illegible] wood, 25-1925 wood, 23-1926 wood and 2-1927 wood. Infection apparently took place in 1926 and a very heavy intensification took place in [illegible]. A nearby tree about 25 feet in height had but one canker. This was apparently on 1923 wood, but had fruited two or possibly three times. As the canker was a large, old one, the infection may have entered in 1921 or 1922 wood and have been due to a 1922 infection.

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Riley and Goodding spent much time scouting the headwaters of Salmon River and the Santiam River, but no pine infections were located and no Ribes infections in association with pines.

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A special study of pine infections in the Rhododendron region was made by Putnam and his crew. Here the disease is wide-spread on the pines and in several places pines are already killed. At one point about two miles above Rhododendron, on Camp Creek, one tree had several hundred cankers.

Blister rust was found on Ribes over a greatly extended territory in spite of the fact that the dryness of the season was unfavorable for the spread and intensification of the disease. North [illegible]

County and the coast region, where infection was found in 1925 and in 1927 and 1928, seemed to be free of the rust. This could be accounted for in part from the meager amount of scouting, but not entirely so. Several very favorable places were scouted without finding a trace of the disease. In strange contrast with this was the infection in the Cochran region where R. bracteosum for miles along several streams was generally and heavily infected. Pines in the Cochran region are very scattered and no good associations were found; but no one seeing the extent and heaviness of infection can doubt that diseased pines are nearby.

No infection was found on the lower Wilson River, but it is prevalent near the headwaters of the stream where pines are common. Here again, infection on pines was not located--probably owing to our inability to find good associations of Ribes and pines.

Of outstanding importance was the location of infection by Root and Harris below Port Orford in Curry County, and that by Partington and Mielke on the Metolius. Considerable scouting by Root, Harris, Benedict and Riley failed to reveal infection along the coast north of Brush Creek. The location made by Partington and Mielke represents a big advance of the rust east of the mountains, and the first point where a good association of Ribes and sugar pines occurs.

The infection on Devils Creek, about a mile above Breitenbush Hot Springs, represents the farthest point south on the west side of the Cascades at which infection has been found.

Meager scouting in the Falls City and Marys Peak region revealed the rust on Ribes to be more generally spread then in 1928.

A glance at the chart tabulations will show that infection has been found on four species of Ribes in Oregon in 1929, viz.: R. bracteosum, R. sanguineum, R. triste and R. divaricatum. To this list should be added R. lacustre on which abundant infection was found in the Rhododendron region.

TABLE NO. 5.

RECORD OF BLISTER RUST INFECTIONS FOUND ON PINES IN OREGON, 1929

County	Region	T.	R.	S.	Host	Number Examined	Number Infected	Inspector	Date	Remarks
Clackamas	Salmon River.	4S	7E	2	P. monticola		1	Riley.	8-6-29	A single juvenile canker.
	Still Creek.	4S	8E	2	"	10	1	Lyle.	8-14-29	Within Still Creek planting.
Hood River	Herman Creek.	2N	8E	15	"	15	4	Goodding.	5-29-29	
	Eagle Creek.	1N	8E	6,8,9	"	50	10	Lyle. Putnam and Goodding.	8-15-29 10-18-29	
Wasco	Beaver Creek.	5S	10E	19	"		1	Lyle.	8-14-29	A single juvenile canker.

TABLE NO. 6.

RECORD OF BLISTER RUST INFECTIONS FOUND ON RIBES IN OREGON, 1929.

County	Region	T.	R.	S.	Host	Number Examined	Number Infected	Per Cent Leaves Infected	Per Cent Infected Surface Uredinia	Telia	Necrotic	Association #	Inspector	Date
Benton	Marys Peak.	12S	7W	22	R. bracteosum	50	10	50	0	100	0	Very poor.	Sipe.	9-6-29
Clackamas	Still Creek.	3S	7E	11	"			10					Goodding and crew.	* 7-10-29
	Zig Zag River.	3S	8E	14	"	2	2	10	100	0	0	Excellent.	Goodding and Darker.	7-16-29
	Salmon River.	3S	7E	27	"	100	5	10	0	100	0	Good.	Goodding and Riley.	8-6-29
	Roaring River.	5S	6E	9	"	500	1	2	0	100	0	Very poor.	Riley.	8-9-29
	Fish Creek.	5S	5E	1	"	200	1	1	0	100	0	Very poor.	Riley.	8-10-29
	Fish Creek.	5S	5E	2	"	200	1	1	0	100	0	Very poor.	Riley.	8-10-29
	Fish Creek.	5S	5E	11	"	100	1	1	0	100	0	Very poor	Riley.	8-10-29
	Clackamas River.	5S	6E	21	"	100	1	10	0	100	0	Very poor.	Riley	8-11-29
	Clackamas River.	6S	6E	2	R. sanguineum	25	1	50	0	100	0	Very poor.	Goodding and Riley.	8-15-29
	Collawash River.	6S	6E	22	R. divaricatum	25	5	2	0	100	0	Very poor.	Goodding and Riley	8-17-29
	Eureka Mt.	3S	8E	36	R. bracteosum	50	10	10	0	50	0	Excellent.	Hinckley.	8-29-29
	Still Creek.	3S	8E	35	R. triste	1	1	10	0	100	0	Excellent.	Sipe.	8-30-29
	Veda Lake.	4S	8E	2	R. bracteosum	50	2	10	0	100	0	Excellent.	Sipe.	8-30-29
	Veda Ridge.	3S	8E	35	"	200	5	10	0	75	25	Excellent.	Hinckley	8-30-29
	Veda Lake.	4S	8E	2	"	200	5	10	0	100	0	Very good.	Hinckley.	8-31-29
	Veda Lake Draw.	3S	8E	35	"	200	5	10	0	100	0	Very good.	Hinckley	8-30-29
	Camp Creek.	3S	7E	12	R. lacustre	50	10	50	0	50	50	Excellent.	Goodding and Riley.	10-19-29
	Camp Creek.	3S	7E	12	R. bracteosum			50					Goodding and Riley.	*10-19-29
Curry	Mussel Creek.	34S	14W	20	"			5	0	100	0	Very poor.	Root and Farris.	9-24-29
	Port Orford.	33S	15W	25	"			5	0	100	0	Very poor.	Root and Farris.	9-24-29
	Mussel Creek.	34S	14W	20	"			5	0	100	0	Very poor.	Riley and Root.	10-2-29
	Rumbug Mt.	33S	15W	25	"			5	0	100	0	Very poor.	Riley and Root.	10-2-29
Hood River	Eagle Creek.	1N	8E	9	"	25	2	2	0	95	5	Good.	Goodding and Putnam.	10-18-29
Jefferson	Metolius River.	11S	10E	12	R. petiolare	19	1	1	0	100	0	Excellent.	Partington and Mielke	10-22-29
Marion	Devils Creek.	9S	7E	28	R. bracteosum	50	1	2	0	100	0	Very poor.	Riley.	8-24-29
	Devils Creek.	9S	7E	28	"	500	51	50	0	95	5	Good.	Goodding and Riley.	10-25-29
Polk	Falls City.	8S	6W	16	"	100	10	15	0	100	0	Very poor.	Goodding and Riley.	10-8-29
	Falls City.	8S	6W	17	"	200	10	15	0	100	0	Very poor.	Goodding and Riley.	10-8-29
Tillamook	Wilson River.	1N	6W	3	"	100	3	25	0	100	0	Very poor.	Goodding.	9-16-29
	Wilson River	1N	7W	1	"	50	2	25	0	100	0	Very poor.	Goodding.	9-16-29
	Mt. Hebo.	4S	8W	17	"	50	2	10	0	100	0	Very poor	Lyle.	9-19-29
	Salmon River.	6S	9W	14	"	25	2	5	0	75	25	Very poor.	Riley and Goodding.	9-19-29
	Cochran.	3N	6W	26	"	500	100	50	0	100	0	Very poor.	Goodding.	10-2-29
	Cochran.	3N	6W	27	R. sanguineum	200	1	50	0	100	0	Very poor	Goodding	10-2-29
	Cochran.	3N	6W	22	R. bracteosum	500	100	50	0	75	25	Very poor.	Goodding.	10-2-29
	Cochran.	3N	6W	28	"	500	100	50	0	100	0	Very poor	Goodding.	10-2-29
	Cochran.	3N	6W	35	"	200	50	50	0	80	20	Very poor.	Goodding and Riley.	9-25-29
	Wederberg.	3N	5W	31	"	500	100	50	0	80	20	Very poor	Goodding and Riley.	9-25-29
	Cochran.	3N	6W	35	"	500	100	50	0	80	20	Very poor.	Goodding and Riley.	9-25-29
	Cochran.	3N	6W	33	"	500	100	50	0	80	20	Very poor.	Goodding and Riley	9-25-29
	Salmonberry.	3N	6W	34	"	200	25	50	0	75	25	Very poor.	Goodding and Riley.	9-26-29
Wasco	Bear Spring Creek.	5S	10E	33	R. petiolare	100	1	1	0	100	0	Poor.	Lyle.	9-14-29
Washington	Cochran.	2N	7W	1	R. bracteosum	500	100	50	0	100	0	Very poor.	Goodding.	10-3-29
Yamhill	Grande Ronde	7S	8W	1	"	25	2	10	0	70	30	Very poor	Goodding and Riley.	9-20-29

\# Excellent - Pines 100 feet or less from infected Ribes.
Very good - Pines 101 to 250 feet from infected Ribes.
Good - Pines 251 to 500 feet from infected Ribes.
Poor - Pines 1,001 to 1,500 feet from infected Ribes.
Very poor - Pines over 1,500 feet from infected Ribes.
*See Putnam's studies of the Rhododendron region.

Annual Report 1929
L. N. Goodding

ECOLOGY PROJECTS IN SOUTHERN OREGON, 1929

The ecology work of 1929 was carried on by one man. The work during the summer consisted in writing up and checking over the ecology plots that had been established during the two preceding years, and in making scouting trips into several locations, during which observations of an ecological nature were made.

The most of the plots are of such a nature that at least three or four seasons must elapse before any conclusive data can be obtained from them. Notes were taken on the progress of each plot, and of any changes that have taken place that would have ecological significance.

The following is a brief discussion of the location of these plots, together with a statement of the object for which each was established, some of the results observed and conclusions where there are sufficient data on which to base them.

Most of the plots were milacres, but some were strips and others were irregular in both extent and shape. Space does not permit of careful analysis of each plot. These data can be obtained from reports filed in the Corvallis office. Plots I to XVIII were established in the Prospect area; the others, in or near Still Creek. All were established in 1927 except where otherwise indicated.

Plots I and II were established in a R. klamathense area to determine as many facts as possible regarding the growth of this species from the seedling stage. From the observations it seems evident that R. klamathense comes in readily from seedlings in the soil in at least two years following eradication, but it requires a moist habitat for ecesis. This last point was shown by the fact that practically all of the young seedlings on the drier situations died, while many of those in the shadier and more moist situations survived.

Plot number III was established to secure data on the ecesis of R. cruentum in a lightly burned-over area. All the bushes were eradicated from the plot to be studied. No seedlings had appeared in 1928 or 1929, even where certain portions of the plot had been planted to this species.

Plot number IV, owing to its isolation, was not studied in 1929.

Plot number V was established to secure data on the vigor of growth and seed production of Ribes bushes where they were becoming suppressed by the forest cover. No data were taken on this plot in 1929 as it was considered that sufficient time had not elapsed to produce significant results.

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Plot number III was established to secure data on the presence of R. cruentum in a lightly burned-over area. All the bushes were eradicated from the plot to be studied. No seedlings had appeared in 1928 or 1929, even where certain portions of the plot had been planted to this species.

Plot number IV, owing to its isolation, was not studied in 1929.

Plot number V was established to secure data on the vigor of growth and seed production of Ribes bushes where they were becoming suppressed by the forest cover. No data were taken on this plot in 1929 as it was considered that sufficient time had not elapsed to produce significant results.

Plot number V-a. The problem of this plot was to study the response of R. lobbii to various treatments which it might readily receive in connection with eradication work. One bush was pulled, disturbing the soil about it as little as possible. In 1929 no seedlings or sprouts were found. Another bush was cut off at the crown and the soil cultivated. No new plants or sprouts were found in 1929. A third bush was pulled, the fruit shaken off and the soil cultivated. No seedlings or sprouts were found in 1929. A fourth bush was pulled, disturbing the soil as little as possible, and the fruit shaken off on the ground. No seedlings or sprouts were found. A fifth bush was left without being disturbed. In 1929 this showed signs of dying and had produced but few fruits, and no new growth. A sixth bush was left, but the soil about it was cultivated. No seedlings were found in 1929. From the above results it may be concluded that R. lobbii does not produce seedlings readily through a mere disturbance of the soil, and that it does not sprout readily from the crown after being cut. This last point, however, is at variance with some further observations made on other plots.

Plot number VI was established for a study on the effect of suppression of R. lobbii by the encroaching forest. No data, however, were taken on this plot in 1929 as it was thought that insufficient time had elapsed to produce notable results.

In Plot number VI-a, study was made of the effect of treatment of Ribes bushes similar to that which might be expected in eradication work. One R. lobbii bush was cut off at the surface of the ground, and the soil above it cultivated. In 1929 this showed a healthy 2-year-old sprout. Another R. lobbii left undisturbed and data taken in 1927 had apparently been removed by some one and no data could be taken in 1929. A R. sanguineum bush was grubbed out, but three root stubs with apparently no crown material were left. In 1929 one of these had several vigorous sprouts. Another R. lobbii bush was pulled and the soil disturbed as little as possible. No seedlings or sprouts could be found in 1929. These results indicate that R. lobbii or R. sanguineum may sprout as the result of leaving crowns after eradication, or in the case of R. sanguineum even from large roots left in the ground.

Plot number VII was laid out and planted to Ribes seeds in a 95 per cent shade situation to study germination. No seedlings could be found in 1928 or 1929. It is probable, however, that chipmunks dug up and ate all of the fruits. The plot will be observed next season.

Plot VIII was another plot established to study Ribes germination. It was located in an open burn. Careful examination in 1928 and 1929 showed no seedlings.

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Plot VIII was another plot established to study Ribes germination. It was located in an open burn. Careful examination in 1928 and 1929 showed no seedlings.

Plot IX was established to study the effects of burns of different character on the germination of seeds stored in the duff. The first milacre of this plot was subjected to heavy burning in 1927. Vigorous sprouts from the large R. cereum bush in the middle of the plot were three and four feet long. Another milacre on which no Ribes were present, which was subjected to a light burn, showed no seedlings. A similar plot from which the duff was all removed showed no seedlings. Another milacre used as a check plot, upon which a large R. cereum bush stood, showed no seedlings. Similarly, a bare area, undisturbed, showed no seedlings. Only one thing seemed strikingly evident from observations on this plot: R. cereum will stand heavy burning without being killed. Conclusions regarding germination are probably untimely at this point.

Plot number X was established to study the seeding and sprouting of R. binominatum. It consisted of five sub-plots. Sub-plot A consisted of 20 milacres and had all of the R. binominatum bushes removed (98 plants, 825 feet of live stem). No seedlings or sprouts were found in 1928 or 1929. Sub-plot B, consisting of one milacre, had a large service berry bush in the center with many R. binominatum bushes at its base. This plot was subjected to heavy burning. No seedlings or sprouts were found in 1928 or 1929. Sub-plot C consisted of one milacre of brushy ground with many R. binominatum bushes. This was subjected to light burning. In 1928 this showed many sprouts but no seedlings. In 1929 all of the sprouts had evidently died. Sub-plot D, consisting of one milacre with R. binominatum present, was carefully cleared. No seedlings or new sprouts were found in 1928, but in 1929 there was one discovered which had either been missed or was a sprout from a root or crown left in 1927. Sub-plot E, consisting of one milacre, had all the duff removed. No Ribes seedlings or sprouts had appeared in 1929.

Plot XI was established some distance from Plot X, but was planned to give further data on R. binominatum seeding and sprouting. It likewise was divided into four sub-plots. Sub-plot A had all the R. binominatum eradicated and the duff removed. No seedlings or sprouts were found in 1929. Sub-plot B was lightly burned, the R. binominatum not being removed (9 plants, 50 feet live stem). In 1929 there were several plants with two-year-old stems from the burned crowns, and these were well fruited. Sub-plot C (15 R. binominatum plants, 90 feet live stem) was not disturbed. In 1929 the Ribes had made vigorous growth. Sub-plot D had no Ribes removed, but was subjected to heavy burning. In 1929 there was no evidence of survival or seedlings.

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Plot number X was established to study the seeding and sprouting of R. binominatum. It consisted of five sub-plots. Sub-plot A consisted of 20 milacres and had all of the R. binominatum bushes removed (35 plants, 325 feet of live stem). No seedlings or sprouts were found in 1928 or 1929. Sub-plot B, consisting of one milacre, had a large service berry bush in the center with many R. binominatum bushes at its base. This plot was subjected to heavy burning. No seedlings or sprouts were found in 1928 or 1929. Sub-plot C consisted of one milacre of brushy ground with many R. binominatum bushes. This was subjected to light burning. In 1928 this showed many sprouts but no seedlings. In 1929 all of the sprouts had evidently died. Sub-plot D, consisting of one milacre with R. binominatum present, was carefully cleared. No seedlings or new sprouts were found in 1928, but in 1929 there was one discovered which had either been missed or was a sprout from a root or crown left in 1927. Sub-plot E, consisting of one milacre, had all the duff removed. Neither seedlings or sprouts had appeared in 1929.

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From the above it seems evident that R. binominatum is quite readily killed by fire, and that hand eradication with this species is effective.

Plot XII was established to study the effect of root competition and light intensity on germination of Ribes seeds. But since none of the seeds germinated on any of the plots, the results may be considered nil. A part of the difficulty with experiments of this kind is the damage done by squirrels and mice. This may even account for all of the lack of germination.

Plot XIII was established in 1928 to study the growth of R. cruentum. Data were taken on 21 separate plants that year, but the plot was not studied in 1929 because insufficient time had elapsed to bring about noticeable results.

Plot XIV was established in 1928. It consisted of a strip running through a burned-over area covered with a heavy growth of R. sanguineum and extending into a timbered area. From the data obtained it appears that burning the forest, together with the duff, results in a heavy ecesis of R. sanguineum.

Plot XV was established in 1928. Four milacres of land were cultivated to simulate the conditions which would be produced during the process of logging. In 1929 there was no evidence of Ribes seedlings.

Plot XVI was established in 1928 to study the effect of removal of the underbrush to increase the light intensity. All of the underbrush was cut on the plot and the light intensity increased to perhaps 25 per cent. No Ribes seedlings were observed in 1929.

Plot XVII was established in 1928 in an area in which a growth of R. hallii was being rapidly shaded by increasing forest growth. The Ribes were abundant on open burns. Data will be taken in 1930.

Plot XVIII was established in 1928. It consisted of four milacres in an area with a heavy growth of R. erythrocarpum. All of the plants were hand pulled. In 1929 there were no new plants, seedlings or sprouts to be found. This indicates that R. erythrocarpum yields readily to hand eradication.

Still Creek

Plot I. 96 milacres. Location: near Still Creek. (See 1927 report.) Purpose: to study growth and reproduction of R. sanguineum

From the above it seems evident that *R. binominatum* is quite readily killed by fire, and that hand eradication with this species is effective.

Plot XII was established to study the effect of root competition and light intensity on germination of Ribes seeds. But since none of the seeds germinated on any of the plots, the results may be considered nil. A part of the difficulty with experiments of this kind is the damage done by squirrels and mice. This may even account for all of the lack of germination.

Plot XIII was established in 1928 to study the growth of *R. cruentum*. Data were taken on 21 separate plants that year, but the plot was not studied in 1929 because insufficient time had elapsed to bring about noticeable results.

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on exposed heavily burned areas. Results: production of fruits heavy, but few seeds seem to germinate and the mortality is high. In 1928 a few seedlings were found, but in 1929 these had died out. Apparently conditions are not yet favorable for ecesis of new plants.

Plot II. 32 milacres. Location: a few yards up the slope from plot I. Purpose: to determine the ability of R. sanguineum to sprout from roots left in soil during eradication. Results: observations in 1928 and 1929 would indicate that no sprouting occurs from roots left in soil during eradication in the type of habitat studied (dry exposed hillside, with no duff, and low moisture content in summer).

Plot III. 32 milacres. Location: near plot II. Purpose: to compare efficacy of hand pulling with chopping off at crown, with respect to future sprouting. Results: The bushes of this plot were hand pulled. Observations during 1928 and 1929 revealed no evidence of sprouting from any plant parts left in the soil.

Plot IV. 8 milacres. Location: along a small stream, in a boggy place on the hillside near plots I, II and III. Purpose: to study the spreading of Ribes down a stream onto an eradicated area. The stream banks below the plot were examined in 1928 and 1929. A few seedlings were found. These might have been from seed from the eradicated bushes. Checks of the plot in 1930 and later will be more positive.

Plot V. 32 milacres. Location: near source of small stream west of Eureka Mountain. Purpose: to determine effect of increasing the shade on the growth of R. lacustre and R. bracteosum. To study the spread of Ribes down stream onto an eradicated area by means of fruits. Results: observations in 1928 and 1929 did not indicate much change in shade conditions. The stream was eradicated in 1928, so 1929 seedlings would not necessarily have come from the plot. The stream below the plot will be checked for seedlings in 1930.

Plot VI. This plot had to be eradicated because of infection with blister rust.

Plot VII. 48 milacres. Location: across Still Creek from Blister Rust Camp. Purpose: to check effectiveness of hand pulling as a means of eradicating R. bracteosum in an alder swamp. Results: R. bracteosum was eradicated from the plot in 1927. Observations in July 1928 showed many sprouts from old fragments left, and many seedlings. In August 1929 many of these seedlings had evidently died, as few were found them. It would seem that hand eradication in swampy places leaves many stem fragments that later produce more plants. Seedlings starting here had a high mortality.

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Plot V. 42 milacres. Location: near source of small stream west of Eureka Mountain. Purpose: to determine effect of increasing the shade on the growth of *R. lacustre* and *R. bracteosum*. To study the spread of Ribes down stream onto an eradicated area by means of fruits. Results: observations in 1928 and 1929 did not indicate much change in shade conditions. The stream was eradicated in 1928, so 1929 seedlings would not necessarily have come from the plot. The stream below the plot will be checked for seedlings in 1930.

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Plot VII. 48 milacres. Location: across Still Creek from Blister Rust Camp. Purpose: to check effectiveness of hand pulling as a means of eradicating *R. bracteosum* in an alder swamp. Results: *R. bracteosum* was eradicated from the plot in 1927. Observations in July 1928 showed many sprouts from old fragments left, and many seedlings. In August 1929 many of these seedlings had evidently died, as few were found then. It would seem that hand eradication in swampy places leaves many stem fragments that later produce more plants. Seedlings starting here had a high mortality.

Plots VIII and IX. Plot VIII-1 square chain. Plot IX--1x2 chains. Location: north slope of Eureka Mountain. Purpose: to determine the effectiveness of R. lacustre eradication in moist hillside bogs; spread of Ribes onto eradicated territory; rapidity of re-invasion of this type of habitat by R. lacustre. Results: observations in 1928 and 1929 show a large number of seedlings and several sprouts of R. lacustre on the area. Re-invasion promises to be fairly rapid. The area about the plot was eradicated chemically during 1929, and a careful check should be made of this during 1930.

Plot X. 4 square chains (approximately). Location: northwest of camp, on the slope. Purpose: to determine the probability of R. sanguineum bushes that have been pulled growing when partly covered with soil. Results: many R. sanguineum plants were partly covered and the site of each marked and numbered. The recheck of these in 1928 showed 1 feeble sprout and several seedlings. In August 1929 no plant was found sprouting, and no seedlings were noted, or one-year-old plants. Observations on this and other plots would indicate that 1929 was unfavorable for ecesis of Ribes. (1929 was an unusually dry summer.)

Plot XI. 84 milacres. Location: Below plots I, II and III in wooded swampy area. Purpose: to determine whether R. bracteosum parts, partially buried during eradication, have a strong tendency to sprout. Results: A high per cent (34%) of the plants partly buried were reported in 1928 as rooting or sprouting. Data on separate plants were not taken in 1929.

Wind River Nursery, 1929.

During August 1929, a check was made of certain portions of the hill slopes eradicated in 1927. It was reported that in 1928 certain areas from which R. sanguineum had been eradicated in 1927 were found to have many seedling Ribes on them. A careful check of these areas in 1929 (August) did not reveal any 1928 or 1929 seedlings.

It is probable that the season 1929 (a very dry one) produced a high mortality among Ribes plants that were just becoming established in many areas.

Scouting

Scouting trips to collect ecology data were made along the old wagon road to Huckleberry City, to the ridge west of Union Peak and a few shorter trips adjacent to the ecology plots. These trips were for collecting data on abundance and distribution of Ribes species in relation to various habitat conditions such as altitude, shade, soil, exposure and soil moisture, special attention being paid to associations with white pines.

Plots VIII and IX. Plot VIII-1 square chain. Plot IX-1 chains. Location: north slope of Thumb Mountain. Purpose: to determine the effectiveness of R. lacustre eradication in moist hillside bogs; spread of Ribes onto eradicated territory; rapidity of re-invasion of this type of habitat by R. lacustre. Results: observations in 1928 and 1929 show a large number of seedlings and several sprouts of R. lacustre on the area. Re-invasion promises to be fairly rapid. The area about the plot was eradicated chemically during 1929, and a careful check should be made of this during 1930.

Plot X. 4 square chains (approximately). Location: northwest of camp, on the slope. Purpose: to determine the probability of R. sanguineum bushes that have been pulled growing when partly covered with soil. Results: many R. sanguineum plants were partly covered and the site of each marked and numbered. The recheck of these in 1929 showed 1 feeble sprout and several seedlings. In August 1929 no plant was found sprouting, and no seedlings were noted, or one-year-old plants. Observations on this and other plots would indicate that 1929 was unfavorable for ecesis of Ribes. (1929 was an unusually dry season.)

Plot XI. 84 milacres. Location: Below plots I, II and III in wooded swampy area. Purpose: to determine whether R. bracteosum varieties, partially buried during eradication, have a strong tendency to sprout. Results: A high per cent (24%) of the plants partly buried were reported in 1928 as rooting or sprouting. Data on separate plants were not taken in 1929.

Wind River Nursery, 1929.

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The most thorough single scouting project (in the Crater Lake National Park) has been treated in a separate report.

Summary

The following general conclusions may be drawn:

1. Ribes klamathense (a possible serious species for consideration in blister-rust control) requires a very moist habitat for the seedlings to become established.

2. Chipmunks play a very important role in keeping in check such species as Ribes cruentum.

3. Ecesis of some species of Ribes (R. cruentum and R. lobbii) seems to have taken place during certain favorable seasons rather than each year. The causes of this have not yet been determined.

4. Ribes erythrocarpum can probably be eradicated thoroughly and effectively by hand pulling.

These ecology plots were established in late summer of 1927 and 1928, so more definite data will be expected in 1930 and 1931. Some plots were found to have been damaged by various agencies such as chipmunks, cattle and hunters (by pulling up stakes).

CRATER LAKE NATIONAL PARK

White Pine

A general survey was made of the Crater Lake National Park in 1929 to get ecological data and to study the region from a pre-eradication standpoint. The following notes were taken:

Anna Creek: Western white pines are scattered along both banks of Anna Creek, from Bridge Creek to near the south entrance of the park. A good stand was reported by several park workers to be found north of Anna Creek, and west of Crater Peak.

Union Peak: Very little western white pine was found on the trail to Union Peak, but there are a few trees on the base of the peak itself.

Road to the east entrance of the park: At places along this road, especially where it enters Kerr Valley, there is much scattered western white pine.

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Road to the east entrance of the park: At places along this road, especially where it enters Kerr Valley, there is much scattered western white pine.

Mt. Scott: On the upper slopes of the mountain, about 8,000 feet altitude and above, white-bark is about the only tree. It occurs in places in a fairly dense stand of scrubby trees.

Cloudcap: This peak is covered with a fine growth of white-bark pine, with an intermixture of lodgepole pine and mountain hemlock.

Crater rim: In many places the rim comes up to a rather sharp ridge, and dips off in a steep slope to the lake. These high, sharp ridges are often occupied by a pure stand of scrubby white-bark pine, or by a mixture of white-bark pines and hemlock. These stands are especially noticeable north of Kerr Notch, above Red Cloud Cliff (opposite Cloudcap), and near Glacier Peak and the Watchman.

Rim road: Along Rim road from Cloudcap to the Watchman, white-bark pines occur almost everywhere. In some places these are widely scattered, while in others there are small patches with a high per cent of white-bark pines.

Watchman: The Watchman has a heavy stand of white-bark pines on the west slope.

Slopes of the Crater, to the water's edge: In a trip through the country around the east shore of the lake, it was found that western white pine made up a considerable per cent of the trees found on these steep slopes. The region between Sentinel Rock and the Palisades has in places a considerable growth of western white pines on the less precipitous slopes (e.g., near the Wineglass).

Ribes

Anna Creek (at the Garden of the Gods): Considerable Ribes lacustre or prickly currant was found growing along the banks of the stream. General observations indicate that this condition is typical of most of the streams in the southeast part of the park. The steep walls of the canyon had occasional patches of Ribes binominatum, or Siskiyou gooseberry, and R. erythrocarpum, or Crater Lake currant. The latter was very abundant on the more level areas just above the canyon.

Mt. Scott and Cloudcap: The scouted parts of this territory showed the Ribes species to be scattered and rather scarce.

Crater rim: The sharp ridges between Kerr Notch and Cloudcap were found to be occupied in many places with dense mats of Ribes erythrocarpum. In several locations, these mats grew under or quite near the patches of white-bark pine previously mentioned. This condition is probably more or less general around the entire rim. The points where

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such associations of white pine and R. erythrocarpum were noted, were: Cloudcap Cliff, near the Wineglass, and near Glacier Peak and the Watchman.

Slopes of the Crater: In the region near the Wineglass. R. viscosissimum, or sticky currant, was found growing in association with the white pines. R. lacustre occupies large patches along small streams flowing into the lake, e.g., at the old boat landing and at the end of the old trail.

Summary

These preliminary scouting trips indicate the situation in Crater Lake National Park to be somewhat as follows:

1. Large areas of the park have either no white pines, or often only a negligible number.

2. Many of the streams (e.g., Anna Creek, Sand Creek) are fringed with stands of western white pine of varying degrees of density, in association with Ribes lacustre and other Ribes species.

3. The Crater Rim is occupied in many places by extensive growths of white-barked pine, and in many places heavy mats of R. erythrocarpum are associated with the pines. These often occupy prominent and scenic locations. Protection of these patches of white-bark pine would, in places, involve the eradication of considerable quantities of Ribes plants, while in places such as parts of Cloudcap Mountain, the Ribes associated with white pines are few in number.

Areas that demand most immediate attention are:

1. The rim, entirely around the Crater and probably extending back several hundred yards.

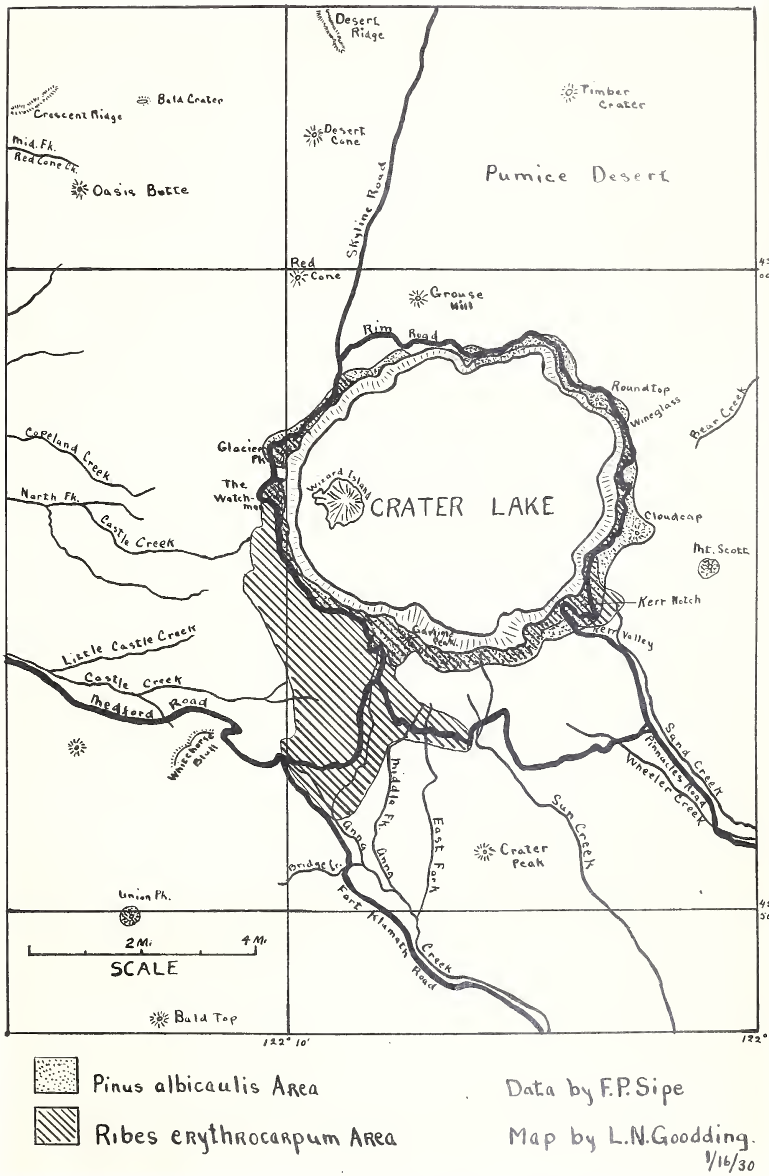
2. The Cloudcap area and Mt. Scott.

3. The inner rim of the crater, at such places as seems desirable (e.g., below Kerr Notch and above Grotto Cove).

4. Anna Creek.

Any program of protection should be flexible, and the plan should be to extend the protection work to all areas of the park that may be in need of protection, as such are revealed by more intensive investigation.

CRATER LAKE NATIONAL PARK



BLISTER-RUST CONTROL WORK IN CALIFORNIA
1929

Blister-rust-control work in California was carried on, as in the past, as a cooperative project between the California Department of Agriculture, California State Board of Forestry, College of Agriculture of the University of California, Department of Botany of the University of California and the Bureau of Plant Industry. The basic memorandum of understanding upon which this work was organized was made effective July 1, 1927 and can be found in the report for that calendar year. The following is the amendment to this memorandum to cover the work as organized for the Federal fiscal year 1930, beginning July 1, 1929:

AMENDMENT TO
MEMORANDUM OF UNDERSTANDING
Effective July 1, 1927

Between
THE UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY
and the
CALIFORNIA DEPARTMENT OF AGRICULTURE - - - THE CALIFORNIA STATE BOARD OF FORESTRY - - - and the COLLEGE OF AGRICULTURE, UNIVERSITY OF CALIFORNIA.

Cooperative Work in Controlling White Pine Blister Rust in CALIFORNIA

* * *

Section D of the Memorandum of Understanding described above reads as follows:

"The College of Agriculture, University of California, agrees to:

"(1) Assist employees of the Bureau of Plant Industry, through the University Division of Forestry, by furnishing available technical advice and records;
"(2) Provide laboratory facilities, through the University Division of Plant Nutrition, for employees of the Bureau of Plant Industry who are stationed in California to conduct technical studies upon the feasibility of chemical eradication of Ribes."

This section shall be amended as follows:

(1) Assist employees of the Bureau of Plant Industry, through the Division of Forestry of the College of Agriculture, by furnishing available technical advice and records;

(2) Provide laboratory facilities, through the Division of Plant Nutrition of the College of Agriculture, for employees of the Bureau of Plant Industry who are stationed in California to conduct

technical studies upon the feasibility of chemical eradication of Ribes.

(3) Provide laboratory and greenhouse facilities and technical advice, thru the Division of Pomology of the College of Agriculture, to permit the necessary increase in experimental work on chemical eradication of Ribes;

(4) Assist the employees of the Bureau of Plant Industry, engaged in technical investigation of the chemical eradication of Ribes, by furnishing, thru the Department of Botany, technical advice and laboratory space.

Paragraph E-6 of the Memorandum of Understanding described above contains the following:

> "For the Fiscal Year 1928, the Bureau of Plant Industry shall contribute in value approximately $19,000 to the support of this cooperative work, the California Department of Agriculture approximately $9,000, the California State Board of Forestry approximately $5,000, and the College of Agriculture, University of California shall contribute in value approximately $3,000; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence."

In accordance with the foregoing provisions, it is mutually agreed that for the fiscal year ending June 30, 1930, there will be contributed in value by the California Department of Agriculture approximately $9,000, by the California State Board of Forestry approximately $3,000, by the College of Agriculture, University of California approximately $10,000 by the Department of Botany, University of California, approximately $2,000, and by the United States Department of Agriculture, Bureau of Plant Industry through its Office of Blister Rust Control, approximately $42,000 in connection with cooperative blister rust control work in California.

Date:	Signature:
9/16/29	(s) G. H. Hecke Director, California Department of Agriculture
9/18/29	(s) M. B. Pratt, by W. B. Rider, Deputy State Forester, California State Board of Forestry
10/5/29	(s) E. D. Merrell Dean, College of Agriculture, University of California
9/10/29	(s) W. A. Setchell Department of Botany, University of California
10/28/29	(s) W. A. Taylor Chief, Bureau of Plant Industry

technical studies upon the feasibility of chemical eradication of Ribes.

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(4) Assist the employees of the Bureau of Plant Industry, engaged in technical investigation of the chemical eradication of Ribes, by furnishing, thru the Department of Botany, technical advice and laboratory space.

Paragraph E-6 of the Memorandum of Understanding described above contains the following:

> "For the Fiscal Year 1928, the Bureau of Plant Industry shall contribute in value approximately $15,000 to the support of this cooperative work, the California Department of Agriculture approximately $3,000, the California State Board of Forestry approximately $5,000, and the College of Agriculture, University of California shall contribute in value approximately $3,000; thereafter the amount to be contributed by each shall be determined and agreed upon by supplemental correspondence."

In accordance with the foregoing provisions, it is mutually agreed that for the fiscal year ending June 30, 1930, there will be contributed in value by the California Department of Agriculture approximately $3,000, by the California State Board of Forestry approximately $3,000, by the College of Agriculture, University of California approximately $3,000, by the Department of Botany, University of California, approximately $1,000, and by the United States Department of Agriculture, Bureau of Plant Industry, through its Office of Blister Rust Control, approximately $21,700 in connection with cooperative blister rust control work in California.

Date:	Signature:
7/15/29	(s) G. H. Hecke Director, California Department of Agriculture
9/12/29	(s) M. B. Pratt, by R. H. Elder, Deputy State Forester, California State Board of Forestry
10/5/29	(s) E. D. Merrill Dean, College of Agriculture, University of California
9/10/29	(s) W. A. Setchell Department of Botany, University of California
10/28/29	(s) W. A. Taylor Chief, Bureau of Plant Industry

BLISTER RUST ACTIVITIES IN CALIFORNIA, 1929

By
George A. Root,
Assistant Pathologist.

Reports on the work under way in California have been prepared by the several project leaders concerned. The reports are by the same leaders as in 1928 -- ecological studies of Ribes by F. A. Patty; control reconnaissance by T. H. Harris; experimental Ribes eradication and pre-eradication on the Plumas National Forest by W. V. Benedict. These follow the proceeding report. The account of the investigations of Ribicides in California is incorporated in H. R. Offord's special report.

BLACK CURRANT ERADICATION

As in former years, work on this particular project has not deviated from the usual procedure. Five men were employed with transportation furnished by three automobiles. The work started July 1 and continued over a period aggregating 13 man months. All the scouts were experienced men. The territory covered involved a wide range of conditions -- from a heavily populated area of many gardens and orchards with considerable water to sparsely settled areas with a scarcity of water in evidence. All this had a bearing upon the rate of progress of the work. The area covered in 1929 was about what was contemplated.

TABLE NO. 1.

PLANTINGS AND BUSHES ACCORDING TO COUNTIES

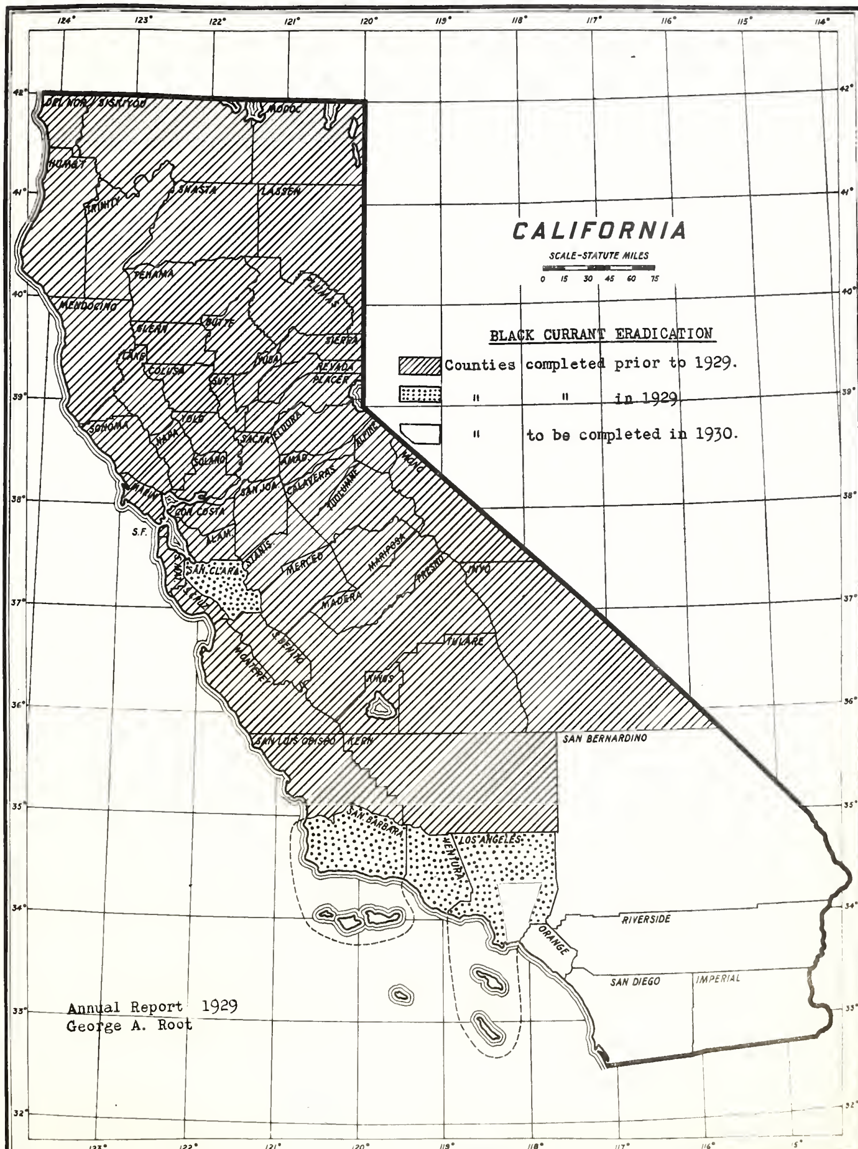
County	No. Plantings	No. Bushes
Santa Clara	20	133
Santa Barbara	1	3
Ventura	1	24
Los Angeles (3/4 completed)	0	0
*Sacramento	3	6
Total	25	166

*New or missed plantings since survey in 1927.

Contrary to expectations the number of plantings and bushes found this year was the smallest of any season. This can be partly accounted for by the type of country covered and then again by the six years' agitation against the black currant which has brought about the

removal of many bushes by the owners themselves during this period. At least 25 plantings, comprising 50 or more bushes, were reported as being removed in this manner.

The state is nearly completed. Five counties and a portion of another are all that remain. One of these and the greater portion of two others can be eliminated. Much of this area is typically desert.


CALIFORNIA
SCALE-STATUTE MILES
0 15 30 45 60 75
BLACK CURRANT ERADICATION
Counties completed prior to 1929.
" " in 1929
" to be completed in 1930.
DEL NOR
SISKIYOU
MODOC
HUMBT
TRINITY
SHASTA
LASSEN
TEHAMA
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
LAKE
COLUSA
YUBA
NEVADA
PLACER
SUT.
SONOMA
YOLO
NAPA
SACRA
ELDORA
ALPINE
MONO
SOLANO
AMAD
MARIN
SAN JOA
CALAVERAS
TUOLUMNE
CON COSTA
S.F.
ALAM.
STANIS.
MERCED
MARIPOSA
SAN CLARA
FRESNO
INYO
MADERA
S. BENITO
TULARE
MONTEREY
KINGS
SAN LUIS OBISPO
KERN
SAN BERNARDINO
SAN BARBARA
VENTURA
LOS ANGELES
ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
Annual Report 1929
George A. Root

JAN 1, 1925

Tentative plans call for a decrease in funds allotted to this project. This will mean that there will be no organized crews next year but that the State Leader with the help of the agricultural commissioners and their inspectors will endeavor to finish the remaining counties--a part of Los Angeles, and all of Orange, San Bernardino, Riverside, Imperial and San Diego. All indications point to a satisfactory completion in this manner.

A check was made of the black currant work done in Alpine County in 1927. With a population of less than 300, ten plantings comprising 92 bushes were found. The check revealed but two places where bushes (sprouts) were still present. On one place, one sprout had come from an original planting of 12 bushes and on the other, two sprouts had come from one of 19 bushes. No missed plantings were discovered nor any as replants. There was a feeling that some bushes might have come in from the Carson Valley in Nevada, adjoining eastern Alpine County.

NURSERY INSPECTION AND QUARANTINE MATTERS

The nurseries in the counties where the black currant work took place were visited by the scouts and host plants, especially 5-needled pines, were inspected. This species is gradually disappearing from the nurseries of the state. Close touch is kept through the Office of the Superintendent of Nursery Service on the establishment of new nurseries and their status regarding the type of stock to be grown.

The discovery of the Mediterranean fruit fly in Florida last April gave an added impetus to quarantine activities in this state. Funds were provided whereby six quarantine stations were established on the Oregon-California line. They are situated on the main highways leading into California and primarily for the interception of contraband fruit. All material prohibited entry, including blister-rust hosts, are taken. Reports have shown the interception of either currants, gooseberries or pines at some station each month since their inception last May.

EDUCATIONAL WORK

This continues to be an important part of the blister-rust program. Government and state agencies realize more than ever the necessity for this work in successfully carrying out their various projects.

A. Panel Exhibits

The 5-panel exhibit has been used as in the past in conjunction

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A check was made of the black currant [illegible] in Alpine County in 1937. [illegible] a population of less than 500, two plantings comprising 52 bushes were found. Our check revealed but two places where bushes (sprouts) were still present. In one place, one sprout had come from an original planting of 12 bushes and in the other, two sprouts had come from one of 11 bushes. No missed plantings were discovered nor any as replants. There was a feeling that some disease might have come in from the Carson Valley in Nevada, adjoining [illegible] Alpine County.

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[illegible]

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a. Panel exhibits

The 6-panel exhibit has been used [illegible] in conjunction

with the black currant project. Placed in store windows or other available places, it has helped carry the message to many people. With the probable termination of the black currant program in 1930, those panels dealing with the black currant exclusively are to be replaced with those showing the other projects carried on in the state. These panels will still find a use in the educational work, being displayed where lectures are given and forming the center, around which can be built very satisfactory demonstrations for small agricultural fairs.

B. Blister Rust Film

This was shown at three different agencies this year: the theater, school and agricultural fair. It was shown in theaters in two towns and in one national park before an audience of 4,100 people; in one high school before several classes aggregating 300 pupils and at one agricultural fair before 1,200 persons, making a total of 5,600 people. The western blister-rust film will lose some of its real value with the termination of the black currant work. There should be a new film showing work of the other projects.

C. Exhibits

The placing of blister rust demonstrations at agricultural fairs still continues to be one of the best means for educational propaganda. Space at the State Fair in Sacramento was at a premium so adequate room for a large display was not available. However, enough space was provided for a display of Riker mounts in connection with the exhibit of the State Department of Agriculture.

A very good demonstration was set up at the Santa Maria Valley Fair in Santa Barbara County. At the Los Angeles County Fair in Pomona, a separate booth was available for a creditable demonstration. At the Southern California Fair in Riverside, one wing of the State Department of Agriculture's exhibit was used for blister rust. All these demonstrations were set up by the black currant scouts and reports from outside sources indicated very good work.

Specimens of the rust were left at the Santa Barbara Museum in Santa Barbara and at the museums in the Yosemite and Lassen National Parks, respectively.

D. Talks

The personal touch occasioned by talks has its advantages. There is usually more interest manifested by the audience, in hearing from one closely associated with the work.

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D. Talks

The personal touch occasioned by talks has its advantages. There is usually more interest manifested by the audience, in return, from one closely associated with the work.

During February a talk supplemented by lantern slides was given before a Boy Scout troop at Elk Grove in Sacramento County. In April, a talk was given before the biology classes of the Polytechnic High School at Long Beach. Lantern slides were used. During July, at the invitation of the Park Naturalist of Yosemite Park, several talks, accompanied by lantern slides, were given before camp groups and an assembly of guests at one of the hotels. The blister-rust work was presented to the Yosemite school of nature study, a group comprising teachers and others particularly interested in the natural sciences. The national park affords excellent opportunity for educational work.

At this point may be mentioned the interview with the Yosemite Park authorities, who are aware of the potential menace of the rust. Their desire is to keep all tree species in the park as free as possible from insect pests and plant diseases. The success which they obtain or will obtain seems to depend largely upon the amount of funds available.

One of the black currant scouts, H. P. Backus, gave a talk before the Rotary Club at Carpinteria in Santa Barbara County. On December 18, a radio talk on blister rust was broadcasted from the station of the State Department of Agriculture in Sacramento.

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Annual Report 1929
G. A. Root

E. Newspapers

The newspaper is still one of the best agencies, through which to reach the public locally. Since the inception of the black currant work, it has been used extensively as a means of publicity. During 1929, articles have appeared in 23 newspapers distributed over four counties where eradication work was in progress.

Space was given for a blister rust article in the October issue of Yosemite Nature Notes, a monthly publication of the Educational Department of Yosemite National Park.

SCOUTING FOR THE DISEASE

The spread of the rust southward in Oregon has created no little interest as to the time of its inevitable entrance into California. Its discovery on the western coast of Oregon in 1928, at a point 100 miles south of the Columbia River made it imperative to scout at least the northwestern part of this state in 1929.

Scouting was started in Del Norte County on September 18, after the completion of work on the other projects. No infections were found.

TABLE NO. 2.

INSPECTION POINTS IN DEL NORTE COUNTY, CALIFORNIA

Locality	Species Examined	Pine Ass'n.	Remarks	Inspectors	Date
Tarup Creek, tributary of Klamath River.	R. bracteosum	*Very poor	-	Benedict and Miller.	9/20/29
Along creek on road leading from Redwood Highway to Requa - 1/4 mile from junction.	R. bracteosum	*Very poor	-	Benedict, Miller, Root and Harris	9/20/29
Wilson Creek - both sides of Redwood Highway.	R. bracteosum	*Very poor	Many bushes north side of creek.	Benedict, Miller, Root and Harris.	9/20/29
Endert's Beach - west side of Redwood Highway.	R. bracteosum R. sanguineum	*Very poor	Bushes near cottages.	Benedict, Miller, Root and Harris.	9/20/29
Junction of Mill Creek and Smith River. Enter through Mill Creek Grove of Big Trees.	R. bracteosum		Take old highway.	Root and Harris.	9/21/29
Mill Creek - where it crosses old highway.	R. bracteosum	*Very poor	-	Root and Harris.	9/21/29
2 miles east of Gasquet along Highway towards Grants Pass, Oregon.	R. sanguineum	#Good	Considerable sugar pine - 12-15 years old.	Root and Harris.	9/21/29
At ~~several~~ creeks along east side of Smith River. Road connects Crescent City-Grants Pass Highway and Crescent City-Smith River Highway.	R. bracteosum	Very poor	-	Root and Harris.	9/22/29
East side of Earle Lake - secondary road.	R. sanguineum R. menziesii R. divaricatum	Very poor	Bushes where road borders swamp.	Root and Harris.	9/22/29
Small creek tributary to Rowdy Creek $1\frac{1}{2}$ miles east of town of Smith River.	R. bracteosum	Very poor	-	Root and Harris.	9/22/29
On Gilbert Creek, northwest corner of county.	R. bracteosum	Very poor	Excellent situation for rust to get hold.	Root and Harris.	9/23/29

*Pines 251 to 500 feet distant.
#Pines over 1,500 feet distant.

In addition to the inspection of Ribes, pines were carefully noted in a trip up Smith River as far as the Oregon line. Most of the pines were on the high ridges on both sides of the river. Just east of Gasquet, is a reproduction of sugar pines, 12 to 15 years of age, covering several acres. R. sanguineum is in the nearby vicinity but no R. bracteosum was found. This area deserves a more thorough study. Some planted 5-needled pines were set out near High Dome, in the northern part of the county in 1915 or 1916. Information obtained this year indicates that a large proportion had been killed by fire. This planting should be investigated in 1930.

The scouting was continued into southwestern Oregon, where infection was found in Curry County, a detailed report of which will be found in the Oregon annual report.

RECOMMENDATIONS

Some plans for the future have been hinted at if not actually suggested in the foregoing report. The black currant eradication should be finished in 1930. At the end of the year this project should have reached the point where the state can be said to be completed. It may take the services of one scout beside the State Leader to accomplish this.

An intensive survey with the purpose of locating infections should be undertaken in the northern part of California, extending from Del Norte County across northern Siskiyou County and possibly Modoc County. Considerable time should be spent in the Smith River drainage in Del Norte County. Four men should be employed on this project.

Extensive scouting should be done throughout the state, especially in the sugar pine regions. A suggestion has been made that a careful study should be made where pinyon rust is encountered--the thought in mind that the blister rust might be found interrelated. This is worthy of consideration.

The time is approaching when the sanitation of forestry nurseries should be considered. There are several in the state owned by the Forest Service and private timber interests. The protection of certain experimental plots of the Forest Service should be given consideration, especially in the 5-needled pine regions.

It goes without saying that the chemical investigations should be continued as well as the ecological work. Some re-eradication should be done. This is being tentatively planned by the Spokane office.

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The good will and cooperation of the various agencies should be continued. This report would not be complete without an expression of appreciation to them for the help given in 1929.

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RIBES ECOLOGY ON THE STANISLAUS NATIONAL FOREST, CALIFORNIA, 1929

By

Frank A. Patty,
Junior Pathologist.

INTRODUCTION

The ecological studies were inaugurated in the sugar-pine region of California on the Stanislaus National Forest in 1928 and were continued during the summer of 1929 on this forest to obtain additional data and information on Ribes conditions as they exist in that region. This forest was selected because it contained a large area of consecutively cut-over lands as well as large stands of virgin timber where studies could be made. More recently fairly large areas have been cut over under the supervision of the United States Forest Service while adjacent areas have been completely denuded of all vegetation by private operators. This variety of existing conditions presented an excellent opportunity to make some interesting studies concerning Ribes regeneration.

The following quotation which was taken from a recent U. S. Forest Service pamphlet concerning this forest will give an idea of the importance of the Stanislaus National Forest. "As a timber producer the Stanislaus is one of the most important national forests in California. The estimated stand on Government land is $9\frac{1}{2}$ million board feet. During 1927 more than 67 million board feet were cut, which brought a revenue to the U. S. Treasury of over $231,859.00". Besides the Government lands, there are even larger holdings of privately-owned lands within the National Forest boundaries. It would probably be a conservative estimate to say that the holdings of the private companies amounted to 20 billion board feet on this forest. At the present rate of cutting, many thousands of acres of forest land will be opened up by cutting operations. After a stand of mature sugar pine has been opened up by cutting operations, the proper conditions apparently are created for the germination and establishment of a substantial Ribes flora on a large part of the area. These Ribes populations, through the agency of blister rust, will be a menace to seed trees and any seedlings of sugar pine which are later established.

The Stanislaus National Forest is located almost due east of San Francisco in about the central part of the Sierra Nevada range of mountains. Hence, ecological conditions may be considered as representative of the middle Sierran Range. Forests 200 miles north or 200 miles south of this forest probably will represent ecological conditions which are somewhat different than those of the Stanislaus. This forest contains the entire headwaters of the Stanislaus River, half of that of the Mokelumne and Tuolumne Rivers and a small part of that of the Merced River. The importance of the forest cover as a watershed cannot be over-

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emphasized because these rivers supply water for power, irrigation and human consumption in the valleys and cities of California.

The region of commercial sugar pine is found in a belt along the western slope of the Sierra Nevada Mountains in the Transitional Life Zone, and for conditions on this forest the altitudinal range of the sugar pine is between 3,000 and 6,500 feet in association with yellow pine, white fir, incense cedar and a small amount of Douglas fir. It is also found in the Canadian Life Zone from 6,500 to 7,500 feet (approximately) in association with Jeffrey pine and red fir. However, at present this region is not considered as one of much commercial importance by the logging companies because of the difficulties in logging and the fact that red fir, which often constitutes most of the stand, is considered an inferior species. It is in this Life Zone that Ribes may be found in abundance growing in the mature stands of timber, especially along the smaller streams or where the moisture table is close to the surface for a greater part of the growing season. Ribes cereum, R. roezli, R. nevadense and R. viscosissimum are the species which grow in such profusion in the Canadian Life Zone. When infection is well established in this region, these dense concentrations will probably aid a great deal in the intensification of the disease in the lower altitudes.

In the Transitional Life Zone or the present commercial belt of coniferous trees, sugar pine is found in association mainly with three other species. Generally speaking the sugar pine is found in association with white fir on the north and east exposures and with yellow pine and incense cedar on the warmer west and south exposures. A few groves of Big trees (Sequoia gigantea) may be found on this forest but they are only important from a botanical and scenic standpoint. Seemingly the Big trees occupy the optimum site for sugar pine on this forest because a good stand of large sugar pine is usually found in association with a grove of Big trees. Due to the enormous size of the Big trees, the presence and size of the sugar pines are seldom appreciated by anyone but a trained forester.

After a cutting, there is usually an appearance of an abundance of woody shrubs including Ribes. Some of the most important of these are the snow bush, the deer bush, wild rose, manzanita, bush chinquapin, the snowberry, bear clover, and Ribes. The bear clover frequently covers entire slopes in a very dense growth almost to the total exclusion of Ribes. Its creeping root stocks and thick resinous leaves make it quite resistant to drought. Bear clover is resistant to killing by fires, sprouting vigorously the year following a ground fire. A group of these plants was burned on May 20 and produced shoots 10 inches

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long by September 15 the same year on a fairly dry site where Ribes were present. In places where the duff and brush are heavy enough to produce a hot burn, the root stocks of the bear clover are killed out and then the Ribes are able to establish themselves with the bear clover which must also come from seed. There is another plant on this forest which may be considered as somewhat detrimental to Ribes growth and this is the bush chinquapin. The dense foliage and the root growth of this species soon kills out most of its associates and as a result a few plants are found in association with it. Ribes are almost never found in association with this bush. The bush chinquapin is not found in such extensive areas as the bear clover so that it is not of much importance in the suppression of Ribes plants by natural or biological means. The two species with which Ribes are so often found in association are the snow bush and the manzanita. There is a temptation to call these two plants "the nursemaids of Ribes" because they are found so frequently growing with Ribes. The low spreading habit of the snow bush apparently creates an ideal situation for the germination and growth of R. roezli, or perhaps it is under the spreading limbs of this species that the chipmunk hides to eat Ribes fruits. In doing so he drops a few seeds. The manzanita with its thick leathery leaves whose margins are often perpendicular to the ground allows enough sunlight to reach the soil for the germination of Ribes seeds and their subsequent growth.

In general it is correct to state that wherever a stand of virgin timber is opened up by fire, the brush will come in to form a fairly dense stand, especially on the moist slopes. On the drier slopes there are many natural openings which are not completely filled in with brush but are more often bare or covered with the low-growing mats of bear clover.

PURPOSE

In general the purpose of the Ribes ecology project is to study the factors which control the germination, growth, dissemination and distribution of Ribes in the sugar-pine regions of California. With a knowledge of these factors, it may be possible to regulate one or more of them in order to aid in the suppression of Ribes in a stand of sugar pine by natural means. In places where suppression is dependent upon the removal of Ribes, these factors should be helpful in carrying out this work.

LOCATION AND DESCRIPTION OF AREAS

All of the work for the ecology project was performed on four major areas on the Stanislaus National Forest. The studies were conducted

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on these areas in order that average conditions over the forest might be obtained. Large rivers or high ridges act as natural boundaries which separate the areas. Most of the cutting has been done on the south half of the forest, south of the middle fork of the Stanislaus River. The north half of the forest represents a large area of virgin timber which will be cut in the future.

A. The Strawberry Area.

The Strawberry area represents a large region which has been cut over under the supervision of the U. S. Forest Service during the last ten years. In addition there was left in this region a fair stand of virgin timber which was available for study. This area was also the scene of the hand eradication work in 1926 and 1927, and part of the experimental chemical eradication in 1927, 1928 and 1929. Several large permanent plots of the U. S. Forest Service were also available for Ribes regeneration studies. Because of the central location and accessibility, most of the permanent plots have been established here.

B. The Rosasco Area.

This area was substituted for the Mather area in 1929 because the latter was found to be very poorly stocked with sugar pine. Rosasco is reached by the narrow gauge railroad of the largest logging company operating on this forest. It is about fifty miles from Tuolumne, California to the present scene of operations of the company. Practically all of the land is privately owned and will be clear-cut. At present only the sugar pine and the yellow pine are cut. The white fir, incense cedar and Douglas fir are left standing or are knocked down in taking out the pine logs. The rolling hills are cut up by precipitous canyons of large and small streams. Many of the slopes of the canyons are so steep that they have not been logged, and the original stand remains surrounded by cut-over areas.

C. The Hazel Green Area.

This is another area in which most of the land is in the hands of logging companies. Hence, the residual stand of timber is almost negligible after logging. It is in this region that some of the best stocked stands of sugar pine may still be found. Yosemite National Park borders it on the east and the Merced River on the south.

D. The Dorrington Area.

The region about Dorrington is still a virgin stand of timber where poorly and well-stocked stands of sugar pine may be found. In 1928

on these areas in order that average conditions over the forest might be obtained. Large rivers or high ridges act as natural boundaries and separate the areas. Most of the cutting has been done on the south half of the forest, south of the middle fork of the Stanislaus River. The north half of the forest represents a large area of virgin timber which will be cut in the future.

A. The Strawberry Area.

The Strawberry area represents a large region which has been cut over under the supervision of the U. S. Forest Service during the last ten years. In addition there was left in this region a fair stand of virgin timber which was available for study. This area was also the scene of the hand eradication work in 1926 and 1927, and part of the experimental chemical eradication in 1927, 1928 and 1929. Several large permanent plots of the U. S. Forest Service were also available for Ribes regeneration studies. Because of the central location and accessibility, most of the permanent plots have been established here.

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D. The Dorrington Area.

The region about Dorrington is still a virgin stand of timber where poorly and well-stocked stands of sugar pine may be found. In 1929

the hand eradication forces performed their work here. A few studies were conducted to note the effect of the removal of Ribes in a virgin stand of timber. The Dorrington area is north of the North Fork of the Stanislaus River and on the northern end of the forest.

METHODS USED IN MAKING STUDIES

The studies conducted during the field season of 1929 can be roughly divided into three groups: (1) permanent plots, (2) temporary plots or strip transects, (3) miscellaneous studies and observations.

A. The Strip Transect Studies.

The strip transect study was used this year instead of the temporary milacre-plot studies because it permitted the sampling of 20 times as much acreage in about the same period of time.

The purposes of this study were to determine how soon Ribes appear after a disturbance by logging, how long they continue to appear, and to note the factors which influence their regeneration.

1. Methods and areas selected. This study was conducted on all of the regions where cutting had been done - Hazel Green, Rosasco and Strawberry. Strips were run on a compass line through the cut-over and virgin areas, using a 2-chain topographic tape with a trailer. At intervals of 2 chains a transect 2 chains long and 13.2 feet wide was established. For convenience the transect was divided into two stations each of which was one chain long and 13.2 feet wide. In other words a plot 2 chains long and 13.2 feet wide was established along a compass line and data were taken for every other transect. The area of the plot represents 40 milacres or one-twenty-fifth of an acre. The transect strips were run at forty-chain intervals through a section so that a fairly representative area could be covered. It was necessary in many cases to run the strips at right angles to the streams to gain information on the conditions more comparable to the area. All of the Ribes in the transect were checked and recorded on the standard forms. This method of sampling the Ribes conditions of an area proved to be rapid. Checks which were made indicated that it was quite efficient and satisfactory for making gross studies of cut-over areas.

B. Permanent Plots.

The permanent plots which were established in the past summer are based on the ones which have been used in north Idaho to study Ribes conditions. Liberal modifications were necessary to suit the conditions of California. It has been necessary in most cases to protect the plots

the hand eradication forces performed their work here. A few studies were conducted to note the effect of the removal of Ribes in a virgin stand of timber. The Dorrington area is north of the North Fork of the Stanislaus River and on the northern end of the forest.

METHODS USED IN FIELD STUDIES

The studies conducted during the field season of 1929 may be roughly divided into three groups: (1) permanent plots, (2) temporary plots or strip transects (3) miscellaneous studies and observations.

A. The Strip Transect Studies.

The strip transect study was used this year instead of the temporary milacre-plot studies because it permitted the sampling of 20 times as much acreage in about the same period of time.

The purposes of this study were to determine how soon Ribes appear after a disturbance by logging, how long they continue to appear, and to note the factors which influence their regeneration.

1. Methods and areas selected. This study was conducted on all of the regions where cutting had been done - Hazel Green, Moresco and Strawberry. Strips were run on a compass line through the cut-over and virgin areas, using a 2-chain topographic tape with a trailer. At intervals of 2 chains a transect 2 chains long and 13.2 feet wide was established. For convenience the transect was divided into two stations each of which was one chain long and 13.2 feet wide. In other words a plot 2 chains long and 13.2 feet wide was established along a compass line and data were taken for every other transect. The area of the plot represents 40 milacres or one-twenty-fifth of an acre. The transect strips were run at forty-chain intervals through a section so that a fairly representative area could be covered. It was necessary in many cases to run the strips at right angles to the streams to gain information on the conditions more comparable to the area. All of the Ribes in the transect were checked and recorded on the standard forms. This method of sampling the Ribes conditions of an area proved to be rapid. Checks which were made indicated that it was quite efficient and satisfactory for making cross studies of cut-over areas.

B. Permanent Plots

The permanent plots which were established in the past summer are based on the ones which have been used in North Idaho to study Ribes conditions. Liberal modifications were necessary to suit the conditions of California. It has been necessary in most cases to protect the plots

W. 854 Donkey logging on private lands. No attempt is made to save young or immature trees.

W.855 Checking the Ribes on the Cow Creek plot. Note the dense brush cover.

with barbed wire fences because the forest land is grazed and browsed heavily by cattle and horses.

In general, the reason for making plot studies is to attempt to correlate some of the factors which control or influence the germination of Ribes seed. With this sort of an arrangement it is possible to control certain factors to a fair degree, for example, a definite amount of shade can be given to a certain group of plots under given conditions and by means of checks the importance of shade can be determined. Each group of plots will be taken up separately and the purpose of each will be explained more in detail.

C. Miscellaneous Studies and Observations

1. Survival-plot studies.

a. Purpose of study. This study was begun for the purpose of following through a group of seedlings from year to year to note the number that survive and at what age the majority of them begin to bear fruit. The effect of removing seedlings and the subsequent disturbing of the ground each year will also be noted.

b. Methods used. An area containing six milacre plots was fenced to prevent trampling by stock. Four of the plots were mapped and the location of each seedling was determined. On the other two plots the seedlings were removed and the ground was stirred with a rake to a depth of about three or four inches. It is planned to record the number of seedlings that appear on these two plots each fall and then stir the soil. On the four plots which were not disturbed the following points will be studied: (1) the number of new seedlings that appear, (2) the increase of live stem, (3) the survival of the bushes, and (4) the year at which most of the bushes begin to fruit. The site occupied by this group of plots is an excellent one for R. roezli because each plot averages about seventy-five seedlings per plot. Germination was started during the summer of 1928. Many veteran bushes near by survived the logging operations which were completed in 1926.

c. Results obtained. No results will be noted until next year because this plot was established in the fall of 1929.

THE COW CREEK PLOT

A. Purpose of Study

This study was begun in 1928 to note the number of Ribes that come back after an area has been cut over and to follow through these

bushes from year to year to determine when they show signs of being shaded out; to determine what species of brush or trees are instrumental in shading out these Ribes.

B. Methods Used.

An area of ten acres at Cow Creek which was cut in 1923 and fenced in 1927 was selected as the best place to carry on this experiment. The fencing will eliminate damages by stock and tourists frequenting this region. All of the bushes were located in 1928 and their ages determined. Each bush was staked with a two-foot stake to make rechecking easy the following years. Ceanothus, bear clover and other forms of brush may be found covering about three-fourths of this entire plot; consequently within a few years shading out and root competition should be showing their effects on the growth of the Ribes plants. During the summer of 1929 the bushes were rechecked again and a number of new bushes were recorded as well as a number of old ones which had been missed the year before while checking. Due to the heavy brush cover it is not surprising that a number of bushes were missed on the first check.

C. Results Obtained.

Table No. 1 shows the results thus far obtained from this study. It is interesting to note that no bushes germinated and survived in 1923 and 1924 while in 1925 twenty-two new bushes were established. The year of 1926 shows the biggest increase and the subsequent three years a steady decline up to 1929. All of the seedlings which were checked in 1929 were found in the immediate vicinity of old bushes or near the base of stumps. During the 7-year period from 1923 to 1929 there has been an increase from 2.6 bushes per acre to 14.6 bushes per acre, or an increase of 485%. Three of the bushes which were established in 1926 were found dead apparently from too much competition by other species of brush, chiefly bear clover.

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C. Results Obtained.

Table No. 1 shows the results thus far obtained from this study. It is interesting to note that no bushes germinated and survived in 1923 and 1924 while in 1925 twenty-two new bushes were established. The year of 1926 shows the biggest increase and the subsequent three years a steady decline up to 1929. All of the seedlings which were checked in 1929 were found in the immediate vicinity of old bushes or near the base of stumps. During the [illegible]-year period from 1923 to 1929 there has been an increase from 2.6 bushes per acre to 14.6 bushes per acre, or an increase of 460%. Three of the bushes which were established in 1926 were found dead apparently from root competition of other species of brush, chiefly bear clover.

TABLE NO. 1.

FREQUENCY DISTRIBUTION OF RIBES BY SPECIES ON COW CREEK EXPERIMENTAL AREA.

Year of Germination and Age Class of Ribes	R. roezli		R. cereum		R. visco.		Ribes Per Acre
	Fruiting	Not Fruiting	Fruiting	Not Fruiting	Fruiting	Not Fruiting	
Present before logging	8	18					2.6
1925 4-year old	4	16		2			2.2
1926 3-year old		39				1	4.0
1927 2-year old		28					2.8
1928 1-year old		15					1.5
1929 seedlings		15					1.5
Total	12	131	0	2	0	1	14.6

GERMINATION PLOT STUDY NUMBER ONE

A. Purpose of Study.

This study was begun to note the effect of the depth of planting, types of soil disturbance, shading and rodents on the germination of seeds of R. roezli.

B. Methods Used.

An area was fenced containing twelve plots each of which was 9.3 feet square or two milacres in area. One tier of four plots was screened with fly screen and shaded; a second tier was screened and the third tier was left unprotected. The plots in row 1 had the duff removed and the soil cultivated to a depth of four inches. In row 2 the soil and the duff were spaded under and the ground was cultivated to a depth of four inches. In row 3 the plots were not disturbed and in row 4 the duff was removed and the soil was left undisturbed. Each plot was divided into four quadrants and in each quadrant fruits of R. roezli were

TABLE NO. 1.

FREQUENCY DISTRIBUTION OF [illegible] TREES BY SPECIES ON [illegible] EXPERIMENTAL AREA

Year of Germination and Age Class of Trees	P. [rozzii] Fruiting	Not Fruiting	[illegible] Fruiting	Not fruiting	[illegible] Fruiting	Not fruiting	[Number] per acre
Present before logging	[illegible]	18					[illegible]
1925, 4-year old	4	16					[illegible]
1926 3-year old		35				1	[illegible]
1927 2-year old		28					[illegible]
1928 1-year old		10					[illegible]
1929 seedlings		[illegible]					[illegible]
Total	[illegible]	121	0		0	1	[illegible]

GERMINATION PLOT STUDY NUMBER ONE

A. Purpose of Study.

This study was begun to note the effect of [illegible] types of soil disturbance, shading and rodents on the germination of seeds of P. rozzii.

B. Methods Used.

An area was fenced containing twelve plots each of which was 1.5 feet square or two milacres in area. The first tier of four plots was screened with fly screen and shaded; a second tier was screened and the third tier was left unprotected. The plots in row 1 had the duff removed and the soil cultivated to a depth of four inches. In row 2 the soil and the duff were spaded under and the ground was cultivated to a depth of four inches. In row 3 the plots were not disturbed and in row 4 the duff was removed and the soil was left undisturbed. Each plot was divided into four quadrants and in each quadrant fruits of P. rozzii were

GRAPH NO. 1

GERMINIATION PLOT STUDY NO. 1

N.

	Unprotected 9.3'		2'	Screened 9.3'		2'	Shaded & Screened 9.3'		
Duff Re-moved	1" Deep	2" Deep		1" Deep	2" Deep		1" Deep	2" Deep	9.3'
	½" Deep	Surface		½" Deep	Surface		½" Deep	Surface	
Un-dis-turbed	1" Deep	2" Deep		1" Deep	2" Deep		1" Deep	2" Deep	9.3'
	½" Deep	Surface		½" Deep	Surface		½" Deep	Surface	
W.									E.
Duff and Soil Dis-turbed	1" Deep	2" Deep		1" Deep	2" Deep		1" Deep	2" Deep	9.3'
	½" Deep	Surface		½" Deep	Surface		½" Deep	Surface	
Duff Re-moved Soil Dis-turbed	1" Deep	2" Deep		1" Deep	2" Deep		1" Deep	2" Deep	9.3'
	½" Deep	Surface		½" Deep	Surface		½" Deep	Surface	

S.

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planted as follows: on the surface of the soil, one-half inch deep, one inch deep and two inches below the surface of the soil.

C. Results Obtained.

Two inspections of the plots after planting showed that 22 per cent of the fruits had been eaten in the unprotected strip. Many of the fruits which had been planted two inches below the surface of the soil had been dug up and the seed had been eaten. In almost every case it was possible to find the empty hull of the Ribes fruit near by.

GERMINATION PLOT STUDY NUMBER TWO

A. Purpose of Study.

This permanent plot was established to study the viability of the seeds for three different years; the effect of various soil disturbances; rodents; and the effect of shading on the germination of the seeds of *R. roezli*.

B. Methods Used.

This plot was prepared similar to plot number one but the depth of planting was made uniform for the entire group. One quadrant in each plot was planted to seeds collected in 1927, one to seeds collected in 1928, one to seeds collected in 1929 and the fourth quadrant was left as a check. The location of this plot is a favorable one for Ribes germination as evidenced by the many seedlings which were growing in close proximity.

C. Results Obtained.

Again the rodents were found digging up the planted fruits and eating the seeds. No check was made on the number of fruits eaten. However, it is believed that a greater percentage were taken from this plot than from study plot number one. It was noted that a number of fruits from the protected strips had been eaten, but this number was rather small.

GERMINATION PLOT STUDIES NUMBERS THREE AND FOUR

A. Purpose of Studies.

These plots which are similar to plots number one and two are placed on north and east exposures where apparently there is plenty of moisture available throughout the year. They were made for the purpose

planted as follows: on the surface of the soil, one-half inch deep, one inch deep and two inches below the surface of the soil.

C. Results Obtained.

Two inspections of the plots after planting showed that 85 per cent of the fruits had been eaten in the unprotected strip. Many of the fruits which had been planted two inches below the surface of the soil had been dug up and the seed had been eaten. In almost every case it was possible to find the empty hull of the Ribes fruit near by.

GERMINATION PLOT STUDY NUMBER TWO

A. Purpose of Study.

This permanent plot was established to study the viability of the seeds for three different years; the effect of various soil disturbances; rodents; and the effect of shading on the germination of the seeds of R. roezli.

B. Methods Used.

This plot was prepared similar to plot number one but the depth of planting was made uniform for the entire group. One quadrat in each plot was planted to seeds collected in 1927, one to seeds collected in 1928, one to seeds collected in 1930 and the fourth quadrat was left as a check. The location of this plot is a favorable one for Ribes germination as evidenced by the many seedlings which were growing in close proximity.

C. Results Obtained.

Again the rodents were found digging up the planted fruits and eating the seeds. No check was made on the number of fruits eaten. However, it is believed that a greater percentage were taken from this plot than from study plot number one. It was noted that a number of fruits from the protected strips had been eaten, but this number was rather small.

GERMINATION PLOT STUDIES NUMBERS THREE AND FOUR

A. Purpose of Studies.

These plots which are similar to plots number one and two are placed on north and east exposures where apparently there is plenty of moisture available throughout the year. They were made for the purpose

of studying the effect of soil disturbance, shading, rodents and exposure on the germination of seedlings of R. roezli.

B. Methods Used.

Both plots were prepared exactly as plots number one and two with the exception that all of the quadrants were planted with fruits at a depth of one-half inch. These fruits were collected in 1928.

GRAPH NO. 2

GERMINATION PLOT STUDY NO. 2

	Unprotected 9.3'		2'	Screened 9.3'		2'	Screened & Shaded 9.3'		
Horizontal Row Plots Spaded Without Removing Duff	1927	1928		1927	1928		1927	1928	9.3'
	1929	Check		1929	Check		1929	Check	
Horizontal Row Duff Removed Spaded	1927	1928		1927	1928		1927	1928	9.3'
	1929	Check		1929	Check		1929	Check	
Horizontal Row Duff Removed	1927	1928		1927	1928		1927	1928	9.3'
	1929	Check		1929	Check		1929	Check	
Horizontal Row Undisturbed	1927	1928		1927	1928		1927	1928	9.3'
	1929	Check		1929	Check		1929	Check	

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C. Results Obtained.

The rodents were digging up the dried fruits and eating the seeds on the unprotected strip. It seems that after seeds have been planted for a period of about two weeks they are no longer molested by animals. This point was borne out for all the plots which have been mentioned so far.

MOISTURE GERMINATION STUDY PLOT

A. Purpose of Study.

On some of the dry sites Ribes are not found in abundance. For the purpose of this study the following hypothesis has been assumed: Ribes seeds may be present in the soil, but many of them fail to germinate and survive on account of the extreme dryness during most of the summer. To determine the validity of this hypothesis, this study has been started on a dry exposure where no Ribes are present within a radius of four chains.

B. Methods of Study.

A set of twelve plots, each with an area of two milacres, was fenced. In row number 1 all of the duff was removed from the plots, and the ground was spaded to a depth of four or five inches. In row number 2 the soil and duff were spaded. Row number 3 was left as a check row with only the trees and large pieces of debris being removed. The set of plots is on a gentle south slope, and the two upper plots for each row were selected as the dry plots. A space ten feet wide was left between the upper plots in the three rows and the lower ones. A trench was dug through the space, and water from a near-by spring turned into it, giving the lower set of plots plenty of moisture. Fruits of R. roezli were planted under four conical wire screens on each plot. It is probable that these screens will afford a greater amount of protection from the rodents than the screened plots which were constructed on plots number one to four. This type of construction also has the advantage of being much cheaper than the other and takes much less time to establish. However, it is possible to use many more plantings with former plots.

C. Results Obtained.

Examinations of the soil during the latter part of the summer showed that the lower set of plots was receiving sufficient moisture to make the soil fairly moist. This study was not started until after the middle of August. Consequently, no germinations were expected in

C. Results Obtained

The rodents were digging [illegible] seeds on the [illegible] planted for a period of [illegible] animals. This point was borne out [illegible] mentioned so far.

[illegible]

A. Purpose of Study.

On some of [illegible] For the purpose of this study the following [illegible] Ribes seeds may be present in the soil, but many of them fail to germinate and survive on account of the extreme dryness [illegible] of the summer. To determine the validity of this hypothesis, this study has been started on a dry exposure [illegible] within a radius of four chains.

B. Methods of Study.

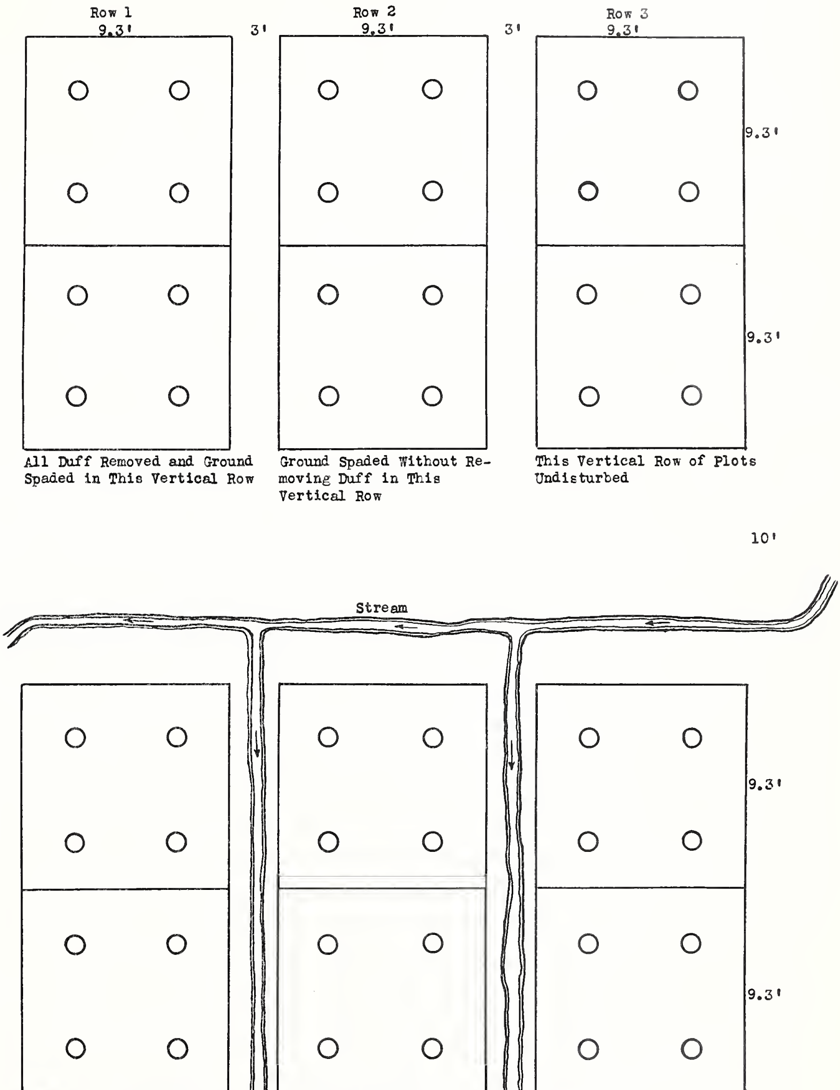
A set of twelve plots, each with an area of [illegible] was fenced. In row number 1 all of the duff was removed [illegible] and the ground was spaded to a depth of four or five inches. In row number 2 the soil and duff were [illegible]. Row number 3 was left as a check row with only the grass and large pieces of [illegible] removed. The set of plots is on a gentle south slope, and the [illegible] for each row were selected as the dry plots. A space [illegible] was left between the upper plots in the three rows and the lower ones. A trench was dug through the space, and water from [illegible] turned into it, giving the lower set of plots plenty of moisture. Fruits of R. roezli were planted under [illegible] on each plot. It is probable that these screens will afford a greater amount of protection from the rodents than the [illegible] which were constructed on plots number one to four. This type of construction also has the advantage of being much cheaper than the [illegible] and takes much less time to establish. However, it is possible to [illegible] plantings with former plots.

C. Results Obtained

Examinations of the soil during the [illegible] showed that the lower set of plots was receiving [illegible] to make the soil [illegible] moist. This study was not [illegible] the middle of August. Consequently, no germinations were [illegible]

Graph No.3.

MOISTURE GERMINATION STUDY PLOT



NOTE: O marks conical screens under which fruits were planted.

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1929. The soil was powder dry to a depth of about four feet in early August on the plots which were not irrigated.

RIBES GERMINATION STUDY BY EXPOSURE AFTER LOGGING

A. Purpose of Study.

This study was begun in 1928 to determine whether there were any differences in the germination of Ribes over a period of years on the north, south, east and west exposures following logging.

B. Methods Used.

The plots were laid out on north, south, east and west exposures in 1928 and rechecked again during 1929. Four plots were placed at equal distances from streams for each exposure, making a total of sixteen plots in all. The first set of plots for each exposure was established approximately six chains from a stream; the second set an additional six chains; the third six chains more; and the last set another six chains, making the final set twenty-four chains from the stream. This method was used to avoid having all the plots for one exposure on a contour instead of being at right angles to the stream. Hence, fairly comparable conditions were probably secured with respect to moisture on each slope.

C. Results Obtained.

From the table there appears to be a fair germination of Ribes on the north and east exposures for a period of five years after a cutting. On the other hand, germination seems to be on a decline for the other two exposures at the end of the five-year period. Further analysis of this table shows that there was no germination during the first year of logging--at least there was no survival.

1959. The soil was powder dry to a depth of about four feet by early August on the plots that were not irrigated.

[illegible] GERMINATION ON [illegible] EXPOSURES

A. Purpose of Study.

This study was begun in 1950 to determine whether there were any differences in the germination of [illegible] on the north, south, east and west exposures following logging.

B. Methods Used.

The plots were laid out on north, south, east and west exposures in 1950 and reexamined again during 1955. The plots were placed at equal distances from stream [illegible], making a total of sixteen plots in all. The first set of plots on each exposure was established approximately [illegible] chains [illegible]; the second set an additional six chains; the third set [illegible]; the last set another six chains, making the [illegible] chains from the stream. This method was used to avoid having all the plots for one exposure on a contour instead of going at right angles to the stream. Hence, fairly comparable conditions were probably secured with respect to moisture on each slope.

C. Results Obtained.

From the table there appears to be a fair germination of [illegible] on the north and east exposures for a period of five years after cutting. On the other hand, germination seems to fail on [illegible] the other two exposures at the end of the five-year period. Further analysis of this table shows that there was no germination during the first year of logging--at least there was no survival.

TABLE NO. 2.

RIBES GERMINATION BY EXPOSURE FOLLOWING LOGGING

Exposure	Number Present Before Logging	Number of Ribes Per Acre Germinating Each Year 1925	1926	1927	1928	1929	Total Ribes Per Acre for 5 Years
North	6		19	87	88	96	290
East	2		20	23	40	24	107
West	4		1	16	25	5	47
South	1		4	10	7	3	24
Total Ribes per acre germinating each year		0	44	136	160	128	

Note: The area on which this study was made was cut in 1925.

ROOT AND CROWN STUDIES OF R. ROEZLI

A. Purpose of Study.

This study was started to determine the regeneration of *R. roezli* caused by (1) the removal of the crown, and (2) leaving the crown in the ground. Another purpose of this plot was to make a study of the seedlings that come in after a bush has been removed.

B. Methods Used.

Four bushes which were grouped together were treated in the following manner: (1) the branches were cut off and the crown left exposed; (2) the branches were cut off and the crown was covered with four inches of soil; (3) the branches and crown were cut off and roots left exposed; (4) the crown and branches were removed and the remaining roots were covered with four inches of dirt. Notations were made on any seedlings found near the bushes. All of the bushes were old and were bearing a small crop of fruit.

C. Results Obtained

The plots were established in the fall, and no results were obtained to date. Twenty-eight groups of bushes with four bushes in each

group were treated as described above. This made a total of one hundred and twelve plants in the study.

THE NEEDLE RETENTION STUDY FOR SUGAR PINE

A. Purpose of Study.

This study was made to obtain some data on the number of years sugar pine holds its needles. The study was confined to young sugar pine trees ten feet or less in height.

B. Methods Used.

The terminal and three of the upper terminal laterals were used for each tree representing four specimens per tree. About an equal number of trees for the four major exposures were selected and needles counted for four branches on each tree.

C. Results Obtained

From these data it appears that sugar pine retains about 22 per cent of its needles in the fifth year, and after that time only a very small number remains on the branches. Too much emphasis must not be placed on this table because many factors such as suppression, age of tree, moisture conditions, and age of stand have not been considered. Some difference in the time the trees hold their needles would probably be found if reproduction in a mature stand and cut-over stand were studied separately.

group were treated as described above. This made a total of [illegible] and twelve plants in the study.

THE [illegible] STUDY [illegible]

1. Purpose of Study.

This study was made to obtain some data on the number of years sugar pine holds its needles. The [illegible] was confined to [illegible] pine trees ten feet or less in height.

2. Methods Used.

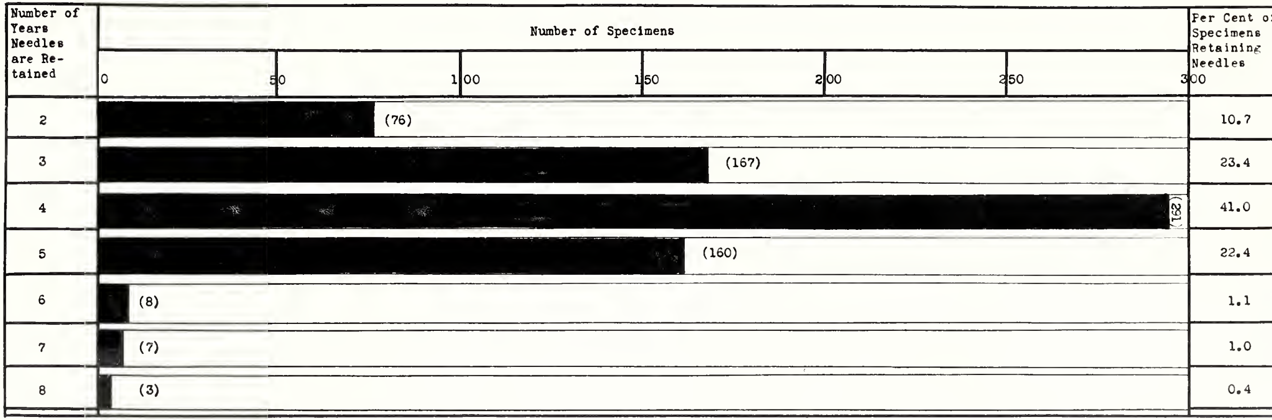
The [illegible] of the sugar [illegible] were used for each tree representing four [illegible] number of trees for the [illegible] major exposures were [illegible] counted for four branches on each tree.

3. Results Obtained

From these data it appears that sugar pine [illegible] of its needles in the fifth year, and after that time only a very small number remains on the branches. Too much emphasis must not be placed on this table because many factors such as suppression, age of tree, moisture conditions, and age of stand have not been considered. Some difference in the time the trees hold their needles would [illegible] be found if reproduction in a mature stand and cut-over stand were studied separately.

GRAPH NO. 4

NEEDLE RETENTION STUDY FOR SUGAR PINE



NOTE: Figures in parenthesis represent number of specimens holding needles for each year.

Annual Report 1929
F. A. Patty

THE INFLUENCE OF OLD BUSHES ON SEEDLING REPRODUCTION

A. Purpose of Study.

This study was started to note the number of Ribes seedlings that appear on plots where bushes were present and where bushes were absent.

B. Method Used.

Plots were established on an equal number of areas where bushes had been removed and a definite amount of soil disturbance had been created. Check plots were laid out where no bushes had been growing but where similar soil disturbances had been caused. In order to obtain conditions that were as nearly comparable as possible, the plots were placed fairly close together. A check was made of these plots one year after the removal of the bushes to ascertain how many seedlings had appeared.

C. Results Obtained.

The following table shows the results of this study one year after the removal of the bushes. In all cases but one there appears to be a decided influence of the old bushes on the number of seedlings that appear. The reason for plot number two failing to produce any seedlings is not known because conditions were quite favorable for germination and survival of seedlings. The plots without bushes on them were placed in the immediate vicinity of the corresponding plots. For example, plot number one was one-half chain from plot number 1-A, plot number two was about a chain from plot number 2-A, etc. It is probable that the plots which produced only a very few bushes per acre received seed from the plots which produced a great many bushes to the acre. There is no doubt a relation of Ribes reproduction to the presence or absence of old bushes. This would point to the fact that seed is probably not stored in the soil in large quantities in this region.

TABLE NO. 3.

INFLUENCE OF OLD BUSHES ON SEEDLING PRODUCTION AFTER BUSHES ARE REMOVED.

	Ribes Per Acre					
	Plot No. 1	Plot No. 2	Plot No. 3	Plot No. 4	Plot No. 5	Plot No. 6
Plots with bushes removed	33	0	25	17	38	5
	Plot No. 1A	Plot No. 2A	Plot No. 3A	Plot No. 4A	Plot No. 5A	Plot No. 6A
Plot without bushes (comparable soil disturbance)	0	0	2	1	1	1

RIBES GERMINATION STUDIES FOLLOWING LOGGING

A. Purpose of Study.

This work was begun to determine how long after a cutting it would be before Ribes would begin to appear and the number of years they continue to germinate on logged-over land.

B. Method Used.

The methods used have been discussed previously under the heading of "Temporary Plots" or "Strip Transect Study".

C. Results Obtained.

The results which were obtained from this study are found in Table No. 4. A summary of the more important points in this table may be listed as follows:

1. The percentage of Ribes germinating during the year of logging is very small.

2. The year following logging there is a fair germination.

3. During the third and fourth years a still greater increase is noticeable.

4. Ten and eleven years following logging a fair percentage of Ribes seed germinate and thus increase the Ribes flora.

TABLE NO. 4.

PERCENTAGE OF RIBES GERMINATING YEAR BY YEAR FOLLOWING LOGGING

Year of Logging	Timber Types	Year of Germination 1928 R. roez.	1928 R. nev.	1927 R. roez.	1927 R. nev.	1926 R. roez.	1926 R. nev.	1925 R. roez.	1925 R. nev.	1924 R. roez.	1924 R. nev.	1923 R. roez.	1923 R. nev.	1922 R. roez.	1922 R. nev.	1921 R. roez.	1921 R. nev.	Total R. roez.	Total R. nev.
1928	SP-F	100.0	100.0															100	100
	SP-YP	100.0	-															100	-
1927	SP-F	94.7	98.6	5.3	1.4													100	100
	SP-YP	40.0	-	60.0	-													100	-
1926	SP-F	46.7	63.0	42.9	32.3	10.3	4.7	0.1										100	100
	SP-YP	59.7	73.1	27.8	23.1	12.5	3.8											100	100
1925	SP-F	41.5	41.4	41.6	43.7	15.4	13.7	1.5	1.2									100	100
	SP-YP	18.3	100.0	47.0	-	28.7	-	6.0	-									100	100
1924	SP-F	18.8	31.0	35.9	41.4	25.8	34.1	13.2	3.5	6.3								100	100
	SP-YP	35.4	20.0	27.7	20.0	24.6	20.0	12.3	40.0									100	100
1922	SP-F	15.0	-	25.0	50.0	30.0	50.0	25.0	-	5.0								100	100
1921	SP-F	10.2	-	8.8	3.6	14.3	67.8	27.0	21.4	38.3	3.6	1.4	3.6					100	100
	SP-YP	6.1		16.2		32.4		36.8		8.5								100	-
1920	SP-F	9.2		21.4		17.4	9.0	22.4	45.5	19.4	45.5	3.4		3.4		3.4		100	100
	SP-YP	12.5		40.0		17.5		25.0		5.0								100	-
1918	SP-F	12.9		12.9		9.7		25.8		22.6		9.7		3.2		3.2		100	-
	SP-YP			9.1		18.2		45.6		15.2		9.1		2.8				100	-

GENERAL STUDIES AND OBSERVATIONS

A number of general studies were started, and they will be only briefly mentioned in this report. There are also a number of studies which were started in 1928 but so far have not had sufficient time to yield any significant data.

1. A twenty-acre experimental plot was logged on a selective basis. Eighteen years later all of the mature trees were removed. A minimum amount of disturbance was caused to the ground and ground cover by the last cutting. This plot is to be followed through from year to year to check the Ribes regeneration. The entire plot is covered with a fair stand of reproduction and a fair amount of brush. This is one of the original study plots of the U. S. Forest Service, which has been under surveillance for many years.

2. A five-acre plot of sugar pine-fir type, was carefully gone over, and all of the Ribes were removed. An adjacent plot of five acres was laid out near by, and the number of feet of live stem and Ribes were recorded. These plots are to be studied to note the effects of removing Ribes before and after a cutting with the idea in mind of determining the source of seed which produces Ribes after logging.

3. Two five-acre plots in the sugar pine-yellow pine type were also established and treated in the same manner as the plots under number two. The purpose of these plot studies is the same as that outlined in study 2 above. The trees on all of these plots were felled about two weeks after the data had been taken on them.

4. Four hundred Ribes fruits were planted four inches apart in rows. Two days after planting an examination was made and 29 per cent of the fruits had disappeared. A second examination five days later revealed that 35 per cent of the total number had been eaten. In most all cases the empty hulls of the fruits were found near by. The study was interrupted by a herd of cattle which spent the afternoon on this study plot.

5. Two bushes having a total of 438 fruits were placed near camp where observations could be made. In four days all of the fruits had been eaten or carried away by two chipmunks.

6. A box with ten compartments was built, screened, and placed in the ground. In each compartment 200 fruits of *R. roezli* were placed. The box was then covered with a few inches of soil and duff. It is planned to remove 200 fruits from one of the compartments each year and test

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4. Four hundred Ribes fruits were planted four inches apart in rows. Two days after planting an examination was made and 25 per cent of the fruits had disappeared. A second examination five days later revealed that 25 per cent of the total number had been eaten. In most all cases the empty hulls of the fruits were found near by. The study was interrupted by a herd of cattle which spent the afternoon on this study plot.

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them in the laboratory each winter by the method worked out at the Boyce Thompson Institute.

7. During the latter part of the summer many examinations were made of R. roezli and R. nevadense for rusts. At Strawberry it was possible to find Cronartium occidentale on R. roezli wherever the latter was in exposed locations. The infection on R. roezli was very heavy in many cases. Careful examinations of R. nevadense failed to show even a single infection on bushes that were growing in close association with heavily infected R. roezli bushes.

8. No attempt was made to study the year at which Ribes begin to fruit because of the heavy frost which upset normal fruiting conditions.

9. A recheck of the burned brush piles and a study of additional piles gave the same results as last year. The brush pile burns do not have any marked effect upon the Ribes stand in the immediate vicinity. Ribes were found growing around the edge of the piles but not in the center or in the hot part of the burns. In no case was there any reproduction of Ribes in large numbers around the edges. Usually where bushes were found near the edge of the burn, they were found in equal abundance within a radius of twenty-five to thirty feet of the burn. Conversely, where no bushes were found near the edge of the burn there were none within a radius of from twenty-five to thirty feet around it. Thus, it is possible to state that the brush pile burns influence Ribes germination very little if any at all. If conditions are favorable for germination, there will be Ribes produced as long as the soil disturbance has been caused.

10. A set of thirty-six milacre plots was established last year. Various soil disturbances were applied, and fruits were planted. (The detailed description of this plot may be found in the 1928 Annual Report.) None of the planted fruits germinated in 1929. However, two volunteers appeared on one of the shaded plots. This plot is on a rather dry exposure, and a few old Ribes bushes may be found three chains north of it.

11. During the season, new plants which were encountered were collected and identified. It is planned to have a collection of all of the plants that are found in association with Ribes. At present there is no immediate need for such a collection of plants, but future plans may call for a knowledge of these plants. This list now has the names of about one hundred and twenty plants in it.

12. Collections were made of R. roezli leaves for further study on the leaf-area and live-stem ratios. No collections have been made of the

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other species for it does not seem that these species will be of major importance except R. nevadense along the streams and on the moist slopes.

13. Records were kept of humidity readings day by day along the rivers and streams. These records showed that during July the humidity averaged 85 per cent at 7 a.m., 25 per cent at noon and 40 per cent at 6 p.m. These readings were taken in the shade at camp.

14. Observations were made along old railroad grades to ascertain the frequency of Ribes. It was found that wherever conditions were favorable Ribes were quite numerous on these grades. Thus if Ribes bushes were found adjacent to the grade they would be found on the grades themselves. This was especially true on north slopes where moisture conditions were apparently ideal for the germination and survival of bushes. The grades on the south exposures showed very few bushes growing on them.

DISCUSSION AND CONCLUSIONS

It must be understood that any conclusions which may be drawn at this time are mostly the results of observation, for sufficient data are not available from which to make any definite statements.

The assumption was made that R. roezli bushes which were growing in mature timber did not produce fruit in abundance. The studies last year indicated that this was not true. During the past summer it was quite evident that the species in question produces a good crop of fruit in virgin timber.

The heavy frost killed a majority of the blossoms on the R. roezli before the fruits had a chance to set. At Hazel Green on some of the northern exposures on the cut-over lands a few bushes were found bearing heavily. As a whole there were few fruits to be found except in the mature stands or where the bushes had been protected from the frost. This meant that during 1929 practically all of the bushes producing good crops of fruit were in the mature timber because the bushes on the cut-over land had been injured by frost. Even some of the shrubs, such as Ceanothus cordulatus, Arctostaphylos patula and Symphoricarpos malus had their succulent growing parts killed when the plants were not in protected places.

The part that the rodents play in the dissemination of Ribes seed is still a matter of conjecture. It is known that chipmunks harvest most of the fruits and eat the seeds and pulp. Feeding experiments indicate that the seeds are thoroughly chewed before they are ingested. Consequently, they do not pass through the animal intact. In all probability many seeds are dropped by this animal, especially when it is suddenly frightened by something. A few fruits are left on the bushes each year. These dry up and fall to the ground. This is

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especially true of fruits which have been mildewed and as a result have become unpalatable for rodent consumption. However, during the current field season, it was difficult to find many ripe berries because they were taken by chipmunks as soon as they had ripened.

After logging there is a period of one or two years before Ribes begin to germinate in large numbers. Then there is a period of "maximum germination" which continues from two to three years after which there is a rapid decline. Much of the logging is done in the dry season. The ground is torn to pieces and dried out by the skidding operations. Therefore, it is not surprising that germination is slight the first year. Many of the stored seeds are probably deeply buried and are not uncovered until the coming of the rain and snow. It has been found that alternate freezing and thawing of Ribes seeds under artificial conditions tend to shorten the rest period of the seed and to permit germination in the laboratory. Perhaps alternate freezing and thawing are essential to the seeds which are stored in the soil before germination can take place.

There are many dry sites where only a few Ribes are found per acre. Probably there are seeds stored in the soil, but moisture conditions are not favorable for germination and survival of the bushes. On these dry sites seedlings are usually found growing in the shade of a rock, a log or a bush. A log in contact with the soil offers an attraction to the soil moisture and shade for the young plant. This may account for the finding of so many bushes growing near the edge of rocks and logs or even other species of bushes.

It is believed that the biggest factor controlling Ribes is the lack of moisture and that this factor may be closely linked with soil texture.

On favorable sites for Ribes where bushes have been removed, many seedlings are often found in the immediate vicinity the year following the removal. Disturbed areas where bushes were not removed failed to show any Ribes germination even on favorable sites. A few seedlings have appeared, but their numbers are very small as compared to the one where bushes are present. This would point to the fact that there is no large storage of seed in the soil over a long period. At present, the data are not at hand in sufficient numbers to draw any definite conclusions on this important point.

Ribes seedlings continue to appear for eight or ten years after an area has been cut over. Where fire has occurred on a north exposure, *R. nevadense* and *R. roezli* in the majority of cases appear in great profusion. On the drier slopes a fire does not seem to materially increase

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or decrease the Ribes flora.

Soil disturbance is only a factor when other conditions which are favorable to Ribes germination are present.

CONTROL RECONNAISSANCE ON THE LASSEN NATIONAL FOREST, CALIFORNIA, 1929

By
T. H. Harris
Junior Forester.

PURPOSE.

Control reconnaissance was continued in California during the summer of 1929 as a further preliminary step in the acquisition of data necessary to the development of the blister-rust-control program in that state. Control reconnaissance aims to ascertain, by means of a rapid and systematic survey, the location and extent of the major sugar pine stands, the Ribes conditions existing therein, and any other factors that might influence the costs of insuring such areas protection against blister rust.

LOCATION OF WORK AND DESCRIPTION OF AREA

A. Location and Reason for Selection

The Lassen National Forest at the northern end of the Sierra Nevada in northeastern California was the scene of reconnaissance during the 1929 field season. Since to the north the commercial stands of sugar pine diminish in importance and value, and since reconnaissance was completed in 1928 on the Plumas National Forest immediately to the south, it seemed desirable to work the excellent sugar pine stands that intervene between these two areas.

B. General Description

The sugar-pine stands of the Lassen Forest lie on the west slope of the Sierra Nevada at elevations ranging from 4,000 to 6,500 feet. A number of streams, viz. Deer Creek, Mill Creek and Battle Creek, each flowing independently into the Sacramento River, have cut steep,V-shaped canyons through the region. Between these streams are plateau-like areas with a westerly slope which support good sugar pine. The topography south and southwest of Mt. Lassen is more broken and rugged than the gentler country to the west.

A good road system gives access to the major sugar-pine areas. Mineral, on the Red Bluff-Susanville Highway, was the base of supplies for the reconnaissance camp.

Five species of Ribes occur throughout the region. Listed in the order of their abundance they are: Ribes Roezli, R. nevadense,

R. *inerme*, R. *viscosissimum* and R. *cereum*. While R. *nevadense* and R. *inerme* are confined principally to streams and moist situations, R. *Roezli* and R. *viscosissimum* are very generally distributed over drier situations as well, R. *viscosissimum* being a rare species, however. R. *cereum* is found at higher elevations, usually 6,000 feet and above, and frequently in large patches extending in some cases over a considerable area.

The principal timber trees indigenous to the northern Sierra Nevada are: sugar pine (*Pinus lambertiana*, Douglas), western yellow pine (*P. ponderosa*, Lawson), Douglas fir (*Pseudotsuga taxifolia* (Poir) Britton), white fir (*Abies concolor* (Gord.) Parry), and incense cedar (*Libocedrus decurrens*, Torrey). These compose the stands in such varying percentages that at times it is extremely difficult to distinguish the timber types so well defined in the southern Sierra Nevada. An attempt was made, however, to classify the forest into the types hitherto used, namely: sugar pine-yellow pine mature (SP-YP Mat.) and cut-over (SP-YP CO.) types, sugar pine-fir mixed (SP-F Mix.) and cut-over (SP-F CO.), stream mature (St. Mat.), brush, meadow, and minor types. Sugar pine-yellow pine usually occurs in mature stands, while sugar pine-fir occurs in mixed-age classes. Brush type designates solid fields of brush with little or no timber cover, and the heading, Minor Types, includes miscellaneous classifications such as pure fir or pure yellow-pine types.

The principal brush genera are: *Arctostaphyllos* (Manzanita), *Ceanothus*, *Amelanchier*, *Castanopsis*, *Cornus*, *Prunus*, *Quercus* and *Salix*.

C. Detailed Location

For purposes of analysis of data the total area reconnaissanced is divided into three sub-areas which are naturally separable from each other. Descriptions of these follow.

1. The Deer Creek unit comprises the plateau country between Deer Creek and Mill Creek, bounded on the southwest by the lower limit of sugar-pine growth and on the north and east by the disappearance of sugar pine which roughly coincides with the route of the Red Bluff-Susanville Highway. Excellent stands of sugar pine occur on the two and one-half townships which this unit includes. The northern three-quarters of the area is moderately free from brush.

The larger part of the timber is owned by the Red River Lumber Company and the firm of Curtis, Collins and Holbrook; the remainder is in federal ownership. At present the Red River Lumber Company is logging the northeastern edge of the area.

R. inerme, R. viscosissimum and R. cereum. While R. nevadense and R. inerme are confined principally to streams and moist situations, R. roezlii and R. viscosissimum are very generally distributed over drier situations as well, R. viscosissimum being a rare species, however. R. cereum is found at higher elevations, usually 6,000 feet and above, and frequently in large patches extending in some cases over a considerable area.

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The principal brush genera are: Arctostaphylos (manzanita), Ceanothus, Amelanchier, Castanopsis, Cornus, Prunus, Quercus and Salix.

C. Detailed Location

For purposes of analysis of data the total area reconnaissanced is divided into three sub-areas which are naturally separable from each other. Descriptions of these follow.

1. The Deer Creek unit comprises the plateau country between Deer Creek and Mill Creek, bounded on the southwest by the lower limit of sugar-pine growth and on the north and east by the disappearance of sugar pine which roughly coincides with the route of the Red Bluff-Susanville highway. Excellent stands of sugar pine occur on the two and one-half townships which this unit includes. The northern three-quarters of the area is moderately free from brush.

The larger part of the timber is owned by the Red River Lumber Company and the firm of Curtis, Collins and Holbrook; the remainder is in Federal ownership. At present the Red River Lumber Company is logging the northeastern edge of the area.

2. The Yellow Jacket unit includes the sugar-pine type between Mill Creek and Battle Creek. It was cut-over thirty or forty years ago by the Diamond Match Company, which is the present owner of the greater part of this unit. The Forest Service administers scattering sections. The timber growth resulting after logging is a heterogenous mixture of types composed of the timber species of all ages and sizes and in varying percentages. Brush and dense reproduction are prevalent; in some parts sugar-pine reproduction is good, but is scattering in general.

3. The Rock Creek unit defines the excellent body of sugar-pine type lying between the South Fork of Battle Creek on the south, Latour Butte on the north, Mt. Lassen on the east and the limit of sugar-pine growth on the west. Ownership is divided between the Diamond Match Company and several small operators. The latter are cutting the sugar pine in the northern part in the vicinity of Viola and Latour Butte. The Federal government owns a little timber along the eastern edge of the unit. There occurs on Sugar Pine Flat, an area of approximately 6 sections, the finest body of mature sugar pine observed during the survey.

METHODS OF WORK

A. Field Methods

Control reconnaissance employed the same field methods for intensive work as were used during 1927 and 1928. Extensive reconnaissance was discontinued because of its proved inefficiency in 1928 under similar conditions. A full explanation of the intensive method is to be found in the annual blister-rust-control report for 1927 under "Control Reconnaissance on Federal Lands, California". Briefly, the basis for the work is the one-man crew working half a section a day using the strip method with sample plots, and the system of public land surveys.

A project leader, five assistants, and a cook composed the field personnel.

B. Office Methods

All office computations, summaries of field data, and the preparation of tables were done by Mr. D. R. Miller of this Office. Reconnaissance data are transferred from section summary sheets to township work sheets where they are readily available, and township maps on a scale of 2" = 1 mile are made from the individual field section maps. These constitute the permanent records of reconnaissance.

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WORK PERFORMED AND RESULTS OBTAINED

The following tables summarize the work and results of control reconnaissance performed on the Lassen National Forest, California. The total area covered is shown by townships and sections and by timber types, and in Table No. 4 an analysis of Ribes data is given.

TABLE NO. 1

PER CENT OF FOREST RECONNAISSANCED.

Classification	Sub-Totals Acres	Sub-Totals Per Cent	Totals Acres	Totals Per Cent
Gross Area of Forest			1,306,807	100.00
Gross Area of SP Types	192,960	100.0	192,960	14.80
Area reconnaissanced	117,927	61.1		9.00

TABLE NO. 2

TYPE DIVISION OF TOTAL AREA RECONNAISSANCED

Eradication Types	Acres	Per Cent
Sugar Pine Types		
SP-YP Mature	48,875.6	41.5
SP-YP Cut-over	3,702.5	3.1
SP-Fir Mixed	45,309.3	38.4
SP-Fir Cut-over	3,529.0	3.0
Totals	101,416.4	86.0
Stream Type Mature	844.1	0.7
Other Types		
Brush	7,102.8	6.0
Meadow	1,218.2	1.1
Minor Types	7,345.5	6.2
Totals	15,666.5	13.3
Grand Totals	117,927.0	100.0

TABLE NO. 3

SECTIONS WORKED RECONNAISSANCE
CALIFORNIA, 1929

Locality	T.	R.	Sections by Number	Totals	
				Section	Acres
Rock Creek	29N	2E	2,3,4,11	4	3,520
	29N	3E	4,5,6,7,8,9,16,17,18	9	5,747
	30N	2E	1,12,24,25,35,36	6	3,440
	30N	3E	3,4,5,6,7,8,9,10,13,15,16,17,18,19,20, 21,22,27,28,29,30,31,32,33,34	25	14,064
	31N	3E	5,6,8,15,16,17,20,21,28,29,30,31,32,33	14	8,816
	32N	2E	21,22,25,26,27,28,29,35,36	9	5,440
	32N	3E	31,32	2	1,120
Yellow Jacket	27N	2E	1,2	2	1,280
	27N	3E	6	1	560
	28N	2E	1,12,23,24,25,26,35,36	8	5,120
	28N	3E	7,19,20,29,30,31,32	7	4,480
	29N	2E	26,35,36	3	1,600
	29N	3E	27,28,29,31,32	5	3,200
Deer Creek	27N	3E	11,12,13,14,15	5	2,900
	27N	4E	2,3,4,5,6,7,8,9,10,17,18	11	7,680
	28N	3E	1	1	960
	28N	4E	1,2,3,4,5,8,9,10,11,12,13,14,15,16,17, 21,22,23,24,25,26,27,33,34,35,36	26	16,640
	28N	5E	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16, 17,18,19,20,23,24,30,31	24	15,360
	28N	6E	5,6,7,8,16,17,18,19,20,21,22	11	7,040
	29N	4E	35,36	2	1,280
	29N	5E	25,26,27,31,32,33,34,35,36	9	5,760
	29N	6E	30,31,32	3	1,920
Totals				187	117,927

TABLE NO. 4

ACREAGE AND RIBES ANALYSIS OF AREAS RECONNAISSANCED
CALIFORNIA 1929

DEER CREEK

Eradication Types	Acres	Ribes Per Acre: Ribes Roezli	Ribes nevadense	Ribes inerme	Ribes viscosissimum	Ribes cereum	Totals
SP-YP Mature	21,231.6	9.74	1.13		0.02	0.31	11.20
SP-YP Cutover	2,234.0	14.82				0.18	15.00
SP-Fir Mixed	24,831.7	15.51	2.74	0.17	2.58	0.36	21.36
SP-Fir Cutover	3,334.0	10.47	0.17			1.70	12.34
Stream Mature	359.6	34.42	132.23	27.96	2.22		196.83
Brush	3,678.2	7.55	1.32				8.87
Meadow	1,049.7	8.51	0.85	0.64		18.30	28.30
Minor Types	2,821.2	10.07	0.82			11.30	22.19
Totals and Averages	59,540.0	14.82	15.26	2.98	1.29	1.14	35.49

YELLOW JACKET

Eradication Types	Acres	Ribes Per Acre: Ribes Roezli	Ribes nevadense	Ribes inerme	Ribes viscosissimum	Ribes cereum	Totals
SP-YP Mature	8,042.4	31.31	1.09				32.40
SP-YP Cutover	1,345.5	16.10					16.10
SP-Fir Mixed	5,280.7	46.74	7.26	0.04			54.04
SP-Fir Cutover	-	-	-	-	-	-	-
Stream Mature	189.1	47.30	78.35	18.70	1.22		145.57
Brush	372.9	2.86					2.86
Meadow	65.0						
Minor Types	944.4	7.39					7.39
Totals and Averages	16,240.0	36.83	19.95	4.20	0.28		61.26

ROCK CREEK

Eradication Types	Acres	Ribes Per Acre: Ribes Roezli	Ribes nevadense	Ribes inerme	Ribes viscosissimum	Ribes cereum	Totals
SP-YP Mature	19,601.6	6.90	0.16	0.07			7.13
SP-YP Cutover	123.0	15.00					15.00
SP-Fir Mixed	15,196.9	19.01	2.36	0.04			21.41
SP-Fir Cutover	195.0						
Stream Mature	295.4	18.73	130.95	38.06	0.18	0.36	188.28
Brush	3,051.7	31.15					31.15
Meadow	103.5	8.33	31.67	3.33			43.33
Minor Types	3,579.9	15.23	0.18				15.41
Totals and Averages	42,147.0	13.39	15.11	4.14	0.02	0.04	32.70

TOTALS

Eradication Types	Acres	Ribes Per Acre: Ribes Roezli	Ribes nevadense	Ribes inerme	Ribes viscosissimum	Ribes cereum	Totals
SP-YP Mature	48,875.6	12.40	0.74	0.03	0.01	0.13	13.32
SP-YP Cutover	3,702.5	15.26				0.11	15.37
SP-Fir Mixed	45,309.3	20.30	3.15	0.10	1.44	0.20	25.19
SP-Fir Cutover	3,529.0	10.05	0.17			1.63	11.85
Stream Mature	844.1	33.77	115.96	28.09	1.35	0.10	179.27
Brush	7,102.8	14.30	0.81				15.11
Meadow	1,218.2	8.49	4.34	0.94		16.23	30.00
Minor Types	7,345.5	11.55	0.46			5.45	17.46
Totals and Averages	117,927.0	17.96	15.98	3.56	0.70	0.59	38.79

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STATEMENT AND ANALYSIS OF COSTS

The cost of control reconnaissance was $.0289 per acre, derived by dividing the total field cost of the project by the total number of acres reconnaissanced.

An analysis of reconnaissance field costs is given in Table No. 5.

TABLE NO. 5

CONTROL RECONNAISSANCE COSTS

Classification	Sub-Total Cost	Sub-Total Per Cent	Total Cost	Total Per Cent
1. Payroll				
a. Supervision(Salary & travel expenses*)	$ 914.93	40.1		
b. Labor(Salaries and expenses)	1,367.67	59.9		
Totals	$2,282.60	100.0	$2,282.60	66.8
2. Subsistence**				
a. Cost of supplies	512.73	63.2		
b. Transportation of supplies	31.24	3.9		
c. Cost of cooking	267.00	32.9		
Totals	$ 810.97	100.0	$ 810.97	23.8
3. Transportation of men	$ 55.85	100.0	$ 55.85	1.6
4. Miscellaneous Travel	$ 67.89	100.0	$ 67.89	2.0
5. Equipment				
a. 1/3 of 1929 purchase	26.67	13.4		
b. 1/3 of 1928 purchase	21.47	10.8		
c. 1/3 of 1927 purchase	48.66	24.5		
d. Supplies not equipment	10.13	5.1		
e. Transportation of equipment	73.66	37.0		
f. Miscellaneous	18.32	9.2		
Totals	$ 198.91	100.0	$ 198.91	5.8
Grand Total			$3,416.22	100.0

*Includes 1,266 miles in Government truck on reconnaissance scouting at $.0730 per mile.

**Number of meals served - 1,873; cost per meal - $0.433.

EXPERIMENTAL RIBES ERADICATION, PLUMAS NATIONAL FOREST, CALIFORNIA

By
W. V. Benedict
Assistant Forest Pathologist

INTRODUCTION

During the period 1926-1928 inclusive, experimental Ribes eradication operations were conducted on the Stanislaus National Forest. This forest region is within the optimum range of sugar pine development. In 1929 the scene of activities was shifted to the Plumas National Forest. The Plumas Forest is located in the northern commercial range of sugar pine and represents a less select site for sugar pine growth.

PURPOSE OF WORK

Within the wide range of latitude included by the sugar pine belt, it is obvious that working conditions, Ribes conditions and timber conditions will vary considerably. Ribes eradication data for the Stanislaus region would not be directly applicable to other, more or less remotely located sugar pine areas. The purpose of the 1929 operation was to procure the necessary Ribes eradication information for formulating blister-rust control measures for the northern Sierra region. This included information on such points as:

a. Classification of eradication types and the acquisition of cost data for such types.
b. Adaption of Stanislaus methods of work to the Plumas locality.
c. The continued training of personnel.

LOCATION OF WORK

The area selected for the 1929 work is fairly well centered in the sugar pine type of the Plumas National Forest. It is located in township 24 north, ranges 8 and 9 east, Mt. Diablo Meridian, approximately 9 miles west of the town of Quincy. The general area in this locality comprising some 37,995 acres, of which the eradication area forms a part, makes up the Meadow Valley working circle of the Plumas Forest. For exact description of boundaries, refer to map accompanying this report.

A. Reasons for Selecting Area

The control reconnaissance data, supplemented by scouting trips of experienced eradication men to the most promising areas, formed the basis for selecting this area. Reasons for this decision were:

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1. Reasons for Selecting Area

The control reconnaissance data, supplemented by scouting trips of experienced eradication men to the most promising areas, formed the basis for selecting this area. Reasons for this decision were:

(1) The Meadow Valley unit represented typical timber site classes (No. II and III) for the region.

(2) Sugar pine was an average representative in the stand.

(3) Three species of Ribes common to the northern Sierra region were present on the area.

(4) Working conditions were typical of the sugar pine type of the locality.

(5) The area was made readily accessible by a series of roads and trails.

B. Description of Area.

The area comprising this unit lies in a natural basin formed by Spanish Creek and its various tributaries. The basin, of which Meadow Valley forms the center, is surrounded by high-ridges on all sides except the east, where Spanish Creek leaves Meadow Valley and runs into American Valley.

The elevation ranges from 3,700 feet around the valley to 5,200 feet on the high ridges.

The topography is rugged and irregular, being cut up by numerous streams with steep canyons.

Lava and serpentine rock formations are numerous.

The forest on this area is composed of a mixed stand of the following species:

Sugar pine 21.8 per cent
Western yellow pine 26.6 per cent
Douglas fir 28.4 per cent
White fir 17.0 per cent
Incense cedar 6.2 per cent

The stand on the timbered area runs approximately 30,000 feet, board measure, per acre, of which 6,540 board feet are sugar pine. (These figures and percentages are based on estimates made by the United States Forest Service for the Meadow Valley working circle.) The stand is largely a composition of all age classes, with a prevalence of mature and over-mature trees, in varying percentages of the above timber species.

Openings in the stand, resulting from fire or insect damage, contain considerable underbrush composed of various species of Ceanothus, manzanita, buckthorn, service-berry, oaks and chinquapin. Along the streams species of willow and alder are found.

C. Eradication Types.

Ribes data and cost data were recorded on the basis of eradication classes, for each eradication type. Four eradication types were recognized, viz., sugar pine-yellow pine-fir type, sugar pine-yellow pine-fir cut-over type, stream type and brush type.

Because of the more or less even representation of sugar pine, yellow pine, Douglas fir and white fir in the stand it was difficult to designate a type as sugar pine-fir or sugar pine-yellow pine in this locality.

The cut-over type, as the name indicates, was an area which had been logged. Cutting had been done several years ago according to Forest Service marking practice.

The brush type consisted of treeless areas on which occurred underbrush of the several species mentioned above.

Stream type consisted of the narrow belt of land bordering water courses.

Four eradication classes, based upon the average acreage of work an eradication crew could do in a day, were used to show the variation in working conditions within an eradication type.

D. Ribes Species.

The three Ribes species indigenous to the area were *Ribes Roezli* constituting 72 per cent of the total, *R. nevadense* consisting of 23 per cent of the total and *R. inerme* numbering 5 per cent of the total.

R. Roezli was the least exacting in growth requirements and occurred on practically all sites. *R. nevadense* was largely restricted to stream bottoms and cool moist slopes. *R. inerme* was confined almost entirely to stream type.

METHODS OF WORK

The eradication project, as organized this season, consisted of two units, one 25-man camp under the supervision of D. R. Miller

(Camp 1) and one 15-man camp under the supervision of E. L. Baxter (Camp 2). Each camp operated independently under the supervision of the project leader. All equipment was procured from Spokane. Subsistence and incidental supplies were procured locally at Quincy. Transportation of men, supplies and equipment was provided by government owned $1\frac{1}{2}$-ton truck.

During the fall of 1928 the area selected for experimental Ribes eradication work was intensively surveyed as described in the 1928 pre-eradication report. The results of this survey supplied the necessary information for planning and conducting the eradication operation.

Sections, or convenient sub-divisions such as $\frac{1}{2}$ sections or $\frac{1}{4}$ sections, were used as working units.

Three-man eradication crews, with foreman working in line, were used exclusively by both camps. Because of the uniform and abundant distribution of Ribes very little scout work was done.

Both twine and small paper squares were used as guide trail. Paper squares were needed to supplant twine near places of habitation and in vicinity of stock driveways and salting grounds.

Each crewman used a special pick mattock to aid in extracting Ribes. All of the crowns and larger roots were removed to prevent sprouting.

The checking work was done by the camp bosses, assisted when necessary by an experienced eradication man. Advance check strips every 20 chains across a section, $\frac{1}{4}$ chain wide and divided into 2-chain transects were established as a part of the pre-eradication work the previous season. These strips were all re-checked after the section had been covered by eradication crews. Special transect traverses were established in stream type and checked similarily to other advance check strips. Information from advance check data made it possible to block out 10.1% of the area as Ribes free.

Methods of pre-eradication were identical with methods developed and described in 1928. The pre-eradication work was done by two experienced eradication men.

(Camp 1) and one 15-man camp under the supervision of [illegible] (Camp 2). Each camp operated independently under the supervision of the project leader. All equipment was procured from Spokane. Subsistence and incidental supplies were procured locally at [illegible]. Transportation of men, supplies and equipment was provided by government owned 1½-ton truck.

During the fall of 1933 the area selected for the experimental Ribes eradication work was intensively surveyed as described in the 1935 pre-eradication report. The results of this survey supplied the necessary information for planning and conducting the eradication operation.

Sections, or convenient sub-divisions such as ¼ sections or ½ sections, were used as working units.

Three-man eradication crews, with foreman working in line, were used exclusively by both camps. Because of the uniform and abundant distribution of Ribes very little scout work was done.

Both twine and small paper squares were used as guide lines. Paper squares were needed to supplement twine near places of habitation and in vicinity of stock driveways and salting grounds.

Each crewman used a special pick mattock to aid in extracting Ribes. All of the crowns and larger roots were removed to prevent sprouting.

The checking work was done by the camp bosses, assisted when necessary by an experienced eradication man. Advance check strips every 20 chains across a section, ½ chain wide and divided into 5-chain transects were established as a part of the pre-eradication work the previous season. These strips were all re-checked after the section had been covered by eradication crews. Special streamtype traverses were established in stream type and checked similarly to other advance check strips. Information from advance check data made it possible to block out 10.1% of the area as Ribes free.

Methods of pre-eradication were identical with methods developed and described in 1933. The pre-eradication work was done by two experienced eradication men.

RESULTS OF WORK

A. Eradication

The following tables summarize the results of the 1929 field operation. For purposes of comparison and analysis the results of the work are shown first, for the project as a whole and second, for each camp unit.

TABLE NO. 1

RESULTS OF ERADICATION BY SECTIONS
(Both Camps)

Section	Eradication Type	Acres	Ribes Eradicated R. Roezli	R. nevad.	R. inerme	Total	Ribes Per Acre	Man-Days On Eradication	Acres Per Man-Day	Cost Per Acre
21	SP-YP-Fir	409.5	47,300	8,648	22	55,970	136.6	225.8	1.7	$ 3.69
21	Stream	76.3	16,625	15,949	2,791	35,365	463.5	141.1	0.5	12.36
21	SP-YP-Fir-Cut-over	154.2	35,879	1,425	-	37,304	241.9	69.5	2.2	3.01
28	SP-YP-Fir	258.7	26,163	12,641	-	38,804	150.0	181.3	1.4	4.69
28	Stream	26.3	3,525	8,844	-	12,369	470.3	90.3	0.3	22.95
22	SP-YP-Fir	40.0	2,569	1,067	-	3,636	90.9	18.2	2.0	3.03
22	Stream	30.0	2,376	3,594	11,762	17,732	591.1	47.9	0.6	10.68
22	SP-YP-Fir-Cut-over	260.0	6,059	454	-	6,513	25.0	45.8	5.6	1.18
27	SP-YP-Fir	615.0	43,786	11,323	-	55,109	86.9	272.9	2.3	2.97
27	Stream	25.0	2,713	7,433	1,013	11,159	446.4	48.0	0.5	12.81
16	SP-YP-Fir	460.0	22,185	6,931	-	29,116	63.2	118.4	3.9	1.72
16	Do-blocked out Ribes Free	155.0	-	-	-	-	-	2.5	62.0	0.11
16	Stream	25.0	2,088	9,040	172	11,300	452.0	59.8	0.4	15.97
26	Stream	5.6	302	983	7,337	8,622	1,539.9	25.4	0.2	30.30
31	SP-YP-Fir	359.1	61,394	6,942	-	68,336	190.3	221.8	1.6	4.13
31	Stream	27.9	7,852	5,019	-	12,871	461.3	37.5	0.7	8.96
31	Brush	53.0	21,143	231	-	21,374	403.3	95.4	0.5	12.04
31	SP-YP-Fir-blocked out Ribes Free	40.0	-	-	-	-	-	0.2	-	0.06
30	SP-YP-Fir	427.1	35,148	6,423	-	41,571	97.3	180.4	2.4	4.82
30	Stream	36.9	1,997	3,258	-	5,255	142.4	36.1	1.4	4.74
30	SP-YP-Fir-blocked out Ribes Free	176.0	-	-	-	-	-	0.5	-	0.01
Totals		3,560.6	339,104	110,205	23,097	472,406	129.1	1,908.8	1.9	$ 3.485

NOTE: Sections 21,28,22,27,16 and 26 worked by Camp 1.
Sections 31 and 32 worked by Camp 2.

TABLE NO. 2

RESULTS OF ERADICATION BY TYPES
(Both Camps)

Eradication Type	Acres In Type	Ribes Eradicated R. Roezli	R. nevad.	R. inerme	Total	Ave. No. Ribes Per Acre	Man-days	Acres Per Man-day	Cost Per Type	Cost Per Acre	% of Total Cost	% of Total Area	% of Total Ribes
SP-YP-Fir*	2,940.4	238,545	53,975	22	292,542	99.5	1,222.0	2.4	$ 8,168.34	$2.78	64.0	80.3	61.9
SP-YP-Fir-CO	414.2	41,938	1,879	-	43,817	105.8	115.3	3.6	770.65	1.86	6.1	11.3	9.3
Brush	53.0	21,143	231	-	21,374	403.3	95.4	0.5	637.95	12.04	5.0	1.5	4.5
Stream**	253.0	37,478	54,120	23,075	114,673	453.2	476.1	0.5	3,182.11	12.58	24.9	6.9	24.3
Totals Including Ribes Free	3,660.6	339,104	110,205	23,097	472,406	129.1	1,908.8	1.9	$12,759.05	$3.485	100	100	100
Totals Excluding Ribes Free	3,289.6	339,104	110,205	23,097	472,406	143.6	1,905.6	1.7	$12,737.36	$3.87	-	-	-

*Includes 371 acres of SP-YP-Fir type blocked out as Ribes free in 3.2 man-days at a cost of $0.06 per acre.

**167.8 acres of stream type were re-worked.
Fifty man-days more required (3.4 acres per man-day).
14.7 Ribes per acre were found on the second eradication.

TABLE NO. 3

RESULTS OF ERADICATION BY CLASSES
(Both Camps)

Eradication Class	Acres In Class	Ribes Eradicated R. Roezli	R. nevad.	R. inerme	Total	Ave. No. Ribes Per Acre	Man-days	Acres Per Man-day	Cost Per Type	Cost Per Acre	% of Total Cost	% of Total Area	% of Total Ribes
A*	937.6	1,900	775	-	2,675	2.9	29.1	32.2	$ 193.94	$ 0.20	1.5	25.6	0.6
B	845.9	22,082	4,781	-	26,863	31.8	155.4	5.4	1,038.59	1.23	8.2	23.1	5.7
C	1,183.3	113,547	21,697	6	135,250	114.3	609.1	1.9	4,071.41	3.44	31.9	32.3	28.6
D	693.8	201,575	82,952	23,091	307,618	443.4	1,115.2	0.6	7,455.11	10.75	58.4	19.0	65.1
Totals Including Ribes Free Area	3,660.6	339,104	110,205	23,097	472,406	129.1	1,908.8	1.9	$12,759.05	$ 3.485	100	100	100
Totals Excluding Ribes Free Area	3,289.6	339,104	110,205	23,097	472,406	143.6	1,905.6	1.7	$12,737.36	$ 3.87	-	-	-

*Excluding 371 acres of Ribes free area the cost of class A is $0.34 per acre.

TABLE NO. 4

RESULTS OF ERADICATION BY TYPES AND CLASSES
(Both Camps)

SP-YP-Fir Type

Eradication Class	Acres In Class	Ribes Eradicated R. Roezli	R. nevad.	R. inerme	Total	Ave. No. Ribes Per Acre	Man-days	Acres Per Man-day	Cost Per Class	Cost Per Acre	% of Total Cost	% of Total Area
Ribes Free	371.0	–	–	–	–	–	3.2	115.9	$ 21.69	$ 0.06	0.2	10.1
A	508.6	1,758	551	–	2,309	4.5	22.8	22.3	151.83	0.30	1.2	13.9
B	530.1	19,191	4,049	–	23,240	40.1	120.3	4.8	803.82	1.39	6.3	15.8
C	1,090.2	102,994	19,566	3	122,563	112.4	558.3	1.9	3,732.02	3.42	29.2	29.8
D	390.5	114,602	29,809	19	144,430	369.9	517.4	0.8	3,458.98	8.86	27.1	10.7
Type Totals	2,940.4	238,545	53,975	22	292,542	99.5	1,222.0	2.4	$8,168.34	$ 2.78	64.0	80.3
SP-YP-Fir-Cutover Type												
A	58.0	142	224	–	366	6.3	3.1	18.7	20.41	0.35	0.2	1.6
B	265.8	2,891	732	–	3,623	13.6	35.1	7.6	234.77	0.88	1.8	7.2
C	59.5	9,141	432	–	9,573	160.9	33.4	1.8	223.28	3.75	1.7	1.7
D	30.9	29,763	491	–	30,255	979.1	43.7	0.7	292.18	9.46	2.3	0.8
Type Totals	414.2	41,938	1,879	–	43,817	105.8	115.3	3.6	$ 770.65	$ 1.86	6.1	11.3
Brush Type												
A	–	–	–	–	–	–	–	–	–	–	–	–
B	–	–	–	–	–	–	–	–	–	–	–	–
C	–	–	–	–	–	–	–	–	–	–	–	–
D	53.0	21,143	231	–	21,374	403.3	95.4	0.5	$ 637.95	12.04	5.0	1.5
Type Totals	53.0	21,143	231	–	21,374	403.3	95.4	0.5	$ 637.95	$12.04	5.0	1.5
Stream Type												
A-B	–	–	–	–	–	–	–	–	–	–	–	–
C	33.6	1,412	1,699	3	3,114	92.7	17.4	1.9	$ 116.11	$ 3.45	0.9	0.9
D	219.4	36,066	52,421	23,072	111,259	507.1	458.7	0.5	3,066.00	13.97	24.0	6.0
Type Totals	253.0	37,478	54,120	23,075	114,673	453.2	476.1	0.5	$3,182.11	$12.58	24.9	6.9

TABLE NO. 5

RESULTS OF ERADICATION BY TYPES
(Camp 1)

Eradication Type	Acres In Type	Ribes Eradicated				Ave. No. Ribes Per Acre	Man-days	Acres Per Man-day	Cost Per Type	Cost Per Acre	% of Total Cost	% of Total Area	% of Total Ribes
		R. Roezli	R. nevad.	R. inerme	Total								
SP-YP-Fir*	1,938.2	142,003	40,610	22	182,635	94.2	819.1	2.4	$5,413.99	$2.79	60.8	76.3	56.5
SP-YP-Fir-CO	414.2	41,938	1,879	-	43,817	105.8	115.3	3.6	765.79	1.85	8.6	16.3	13.6
Stream	188.2	27,629	45,843	23,075	96,547	513.0	412.5	0.5	2,724.80	14.48	30.6	7.4	29.9
Totals Including Ribes Free Area	2,540.6	211,570	88,332	23,097	322,999	127.1	1,346.9	1.9	$8,904.58	$3.50	100	100	100
Totals Excluding Ribes Free Area	2,385.6	211,570	88,332	23,097	322,999	135.4	1,344.4	1.8	$8,886.77	$3.73	-	-	-

*Includes 155 acres of SP-YP-Fir type blocked out as Ribes free in 2.5 man-days at a cost of $0.11 per acre.

TABLE NO. 6

RESULTS OF ERADICATION BY CLASSES
(Camp 1)

Eradication Class	Acres In Class	Ribes Eradicated				Ave. No. Ribes Per Acre	Man-days	Acres Per Man-day	Cost Per Type	Cost Per Acre	% of Total Cost	% of Total Area	% of Total Ribes
		R. Roezli	R. nevad.	R. inerme	Total								
A*	606.4	1,530	700	-	2,230	3.7	20.7	29.3	$ 133.57	$ 0.22	1.5	23.9	0.7
B	706.3	17,605	3,915	-	21,520	30.5	121.8	5.8	810.32	1.15	9.1	27.8	6.7
C	763.7	71,832	13,636	6	85,464	111.9	398.8	1.9	2,635.75	3.45	29.6	30.0	26.4
D	465.2	120,613	70,081	23,091	213,785	459.6	805.6	0.6	5,324.94	11.45	59.8	18.3	66.2
Totals Including Ribes Free Area	2,540.6	211,570	88,332	23,097	322,999	127.1	1,346.9	1.9	$8,904.58	$ 3.50	100	100	100
Totals Excluding Ribes Free Area	2,385.6	211,570	88,332	23,097	322,999	135.4	1,344.4	1.8	$8,886.77	$ 3.73	-	-	-

*Excluding 155 acres of Ribes free area the cost of class A is $0.26 per acre.

TABLE NO. 7

RESULTS OF ERADICATION BY TYPES AND CLASSES
(Camp 1)

Eradication Class	Acres In Class	Ribes Eradicated R. Roezli	R. nevad.	R. inerme	Total	Ave. No. Ribes Per Acre	Man-days	Acres Per Man-day	Cost Per Type	Cost Per Acre	% of Total Cost	% of Total Area
SP-YP-Fir Type												
Ribes Free	155.0	-	-	-	-	-	2.5	62.0	$ 17.81	$ 0.11	0.2	6.1
A	393.4	1,388	476	-	1,864	4.7	15.1	26.1	97.95	0.25	1.1	15.5
B	439.5	14,714	3,183	-	17,897	40.7	86.7	5.1	569.90	1.30	6.4	17.3
C	698.5	62,143	12,768	3	74,914	107.3	362.0	1.9	2,395.33	3.43	26.9	27.5
D	251.8	63,758	24,183	19	87,960	349.3	352.8	0.7	2,333.00	9.27	26.2	9.9
Type Totals	1,938.2	142,003	40,610	22	182,635	94.2	819.1	2.4	$5,413.99	$ 2.79	60.8	76.3
SP-YP-Fir-Cut-over Type												
A	58.0	142	224	-	366	6.3	3.1	18.7	$ 17.81	$ 0.30	0.2	2.3
B	265.8	2,891	732	-	3,623	13.6	35.1	7.6	231.52	0.87	2.6	10.5
C	59.5	9,141	432	-	9,573	160.9	33.4	1.8	222.61	3.74	2.5	2.3
D	30.9	29,764	491	-	30,255	979.1	43.7	0.7	293.85	9.51	3.3	1.2
Type Totals	414.2	41,938	1,879	-	43,817	105.8	115.3	3.6	$ 765.79	$ 1.85	8.6	16.3
Stream Type												
A	-	-	-	-	-	-	-	-	-	-	-	-
B	-	-	-	-	-	-	-	-	-	-	-	-
C	5.7	538	436	3	977	171.4	3.4	1.7	$ 26.71	$ 4.69	0.3	0.2
D	182.5	27,091	45,407	23,072	95,570	523.7	409.1	0.4	2,698.09	14.78	30.3	7.2
Type Totals	188.2	27,629	45,843	23,075	96,547	513.0	412.5	0.5	$2,724.80	$14.48	30.6	7.4

TABLE NO. 8

RESULTS OF ERADICATION BY TYPES
(Camp 2)

Eradication Type	Acres In Type	Ribes Eradicated R. Roezli	R. nevad.	R. inerme	Total	Ave. No. Ribes Per Acre	Man-days	Acres Per Man-day	Cost Per Type	Cost Per Acre	% of Total Cost	% of Total Area	% of Total Ribes
SP-YP-Fir*	1,002.2	96,542	13,365	-	109,907	109.7	402.9	2.5	$2,763.65	$ 2.76	71.7	89.5	73.6
Brush	53.0	21,143	231	-	21,374	403.3	95.4	0.6	655.26	12.36	17.0	4.7	14.3
Stream	64.8	9,849	8,277	-	18,126	279.7	63.6	1.0	435.56	6.72	11.3	5.8	12.1
Totals Including Ribes Free Area	1,120.0	127,534	21,873	-	149,407	133.4	561.9	2.0	$3,854.47	$ 3.44	100	100	100
Totals Excluding Ribes Free Area	904.0	127,534	21,873	-	149,407	165.3	561.2	1.6	$3,850.62	$ 4.26	-	-	-

*Includes 216 acres of SP-YP-Fir type blocked out as Ribes free in 0.7 man-days at a cost of $0.02 per acre.

TABLE NO. 9

RESULTS OF ERADICATION BY CLASSES
(Camp 2)

Eradication Class	Acres In Class	Ribes Eradicated R. Roezli	R. nevad.	R. inerme	Total	Ave. No. Ribes Per Acre	Man-days	Acres Per Man-day	Cost Per Type	Cost Per Acre	% of Total Cost	% of Total Area	% of Total Ribes
A*	331.2	370	75	-	445	1.3	8.4	39.4	$ 57.82	$ 0.17	1.5	29.6	0.3
B	140.6	4,477	866	-	5,343	38.0	33.6	4.2	231.27	1.64	6.0	12.5	3.6
C	419.6	41,725	8,061	-	49,786	118.7	210.3	2.0	1,441.57	3.44	37.4	37.5	33.3
D	228.6	80,962	12,871	-	93,833	410.5	309.6	0.7	2,123.81	9.29	55.1	20.4	62.8
Totals Including Ribes Free Area	1,120.0	127,534	21,873	-	149,407	133.4	561.9	2.0	$3,854.47	$ 3.44	100	100	100
Totals Excluding Ribes Free Area	904.0	127,534	21,873	-	149,407	165.3	561.2	1.6	$3,850.63	$ 4.26	-	-	-

*Excluding 216 acres of Ribes free area the cost of class A is $0.47 per acre.

TABLE NO. 10

RESULTS OF ERADICATION BY TYPES AND CLASSES
(Camp 2)

Eradication Class	Acres In Class	Ribes Eradicated R. Roezli	R. nevad.	R. inerme	Total	Ave. No. Ribes Per Acre	Man-days	Acres Per Man-day	Cost Per Type	Cost Per Acre	% of Total Cost	% of Total Area
SP-YP-Fir Type												
Ribes Free	216.0	-	-	-	-	-	0.7	352.0	$ 3.85	$ 0.02	0.1	19.3
A	115.2	370	75	-	445	3.9	7.7	14.9	53.96	0.47	1.4	10.3
B	140.6	4,477	866	-	5,343	38.0	33.6	4.2	231.27	1.64	6.0	12.5
C	391.7	40,851	6,798	-	47,649	121.6	196.3	2.0	1,345.21	3.43	34.9	35.0
D	138.7	50,844	5,626	-	56,470	407.1	164.6	0.8	1,129.36	$ 8.14	29.3	12.4
Type Totals	1,002.2	96,542	13,365	-	109,907	109.7	402.9	2.5	$2,763.65	$ 2.76	71.7	89.5
Brush Type												
A	-	-	-	-	-	-	-	-	-	-	-	-
B	-	-	-	-	-	-	-	-	-	-	-	-
C	-	-	-	-	-	-	-	-	-	-	-	-
D	53.0	21,183	231	-	21,374	403.3	95.4	0.6	$ 655.26	$12.36	17.0	4.7
Type Totals	53.0	21,183	231	-	21,374	403.3	95.4	0.6	$ 655.26	$12.36	17.0	4.7
Stream Type												
A	-	-	-	-	-	-	-	-	-	-	-	-
B	-	-	-	-	-	-	-	-	-	-	-	-
C	27.9	874	1,263	-	2,137	76.6	14.0	2.0	$ 96.36	$ 3.45	2.5	2.5
D	36.9	8,975	7,014	-	15,989	433.3	49.6	0.7	339.20	9.24	8.8	3.3
Type Totals	64.8	9,849	8,277	-	18,126	279.7	63.6	1.0	$ 435.56	$ 6.72	11.3	5.8

B. Checking

The following two tables summarize the results of the checking work for 1929.

TABLE NO. 11

SUMMARY OF CHECKING
(Camp 1)

Eradication Type	Acres In Type	Acres Checked	% of Check	Ave. No. Ribes Eradicated Per Acre	No. Ribes Missed Per Acre				F. L. S. Missed Per Acre				% of Efficiency	
					R. Roez.	R. nevad.	R. iner.	Total	R. Roez.	R. nev.	R. iner.	Total	By No. of Missed Bushes	By Amt. Missed L. S.
SP-YP-Fir-Ribes Free	155.0	0	0	-	-	-	-	-	-	-	-	-	-	-
SP-YP-Fir	1,783.2	27.8	1.5	102.4	3.5	1.2	-	4.7	17.0	4.8	-	21.8	95.6	98.2
SP-YP-Fir-CO	414.2	6.7	1.6	105.8	5.1	1.5	0.3	6.9	17.3	5.1	1.0	23.4	93.8	98.1
Stream	188.2	7.0	3.7	513.0	3.7	11.4	1.4	16.5	10.8	23.7	2.5	37.0	96.9	99.2
Totals	2,540.6	41.5	1.6	127.1	3.8	3.0	0.3	7.1	16.0	8.0	0.6	24.6	94.7	98.3

Average feet of live stem for pulled bush 11.5.
Average feet of live stem for missed bush 3.5.

TABLE NO. 12

SUMMARY OF CHECKING
(Camp 2)

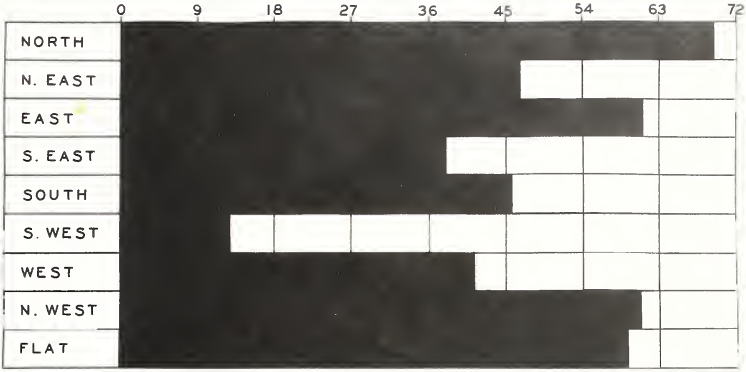
Eradication Type	Acres In Type	Acres Checked	% of Check	Ave. No. Ribes Eradicated Per Acre	No. Ribes Missed Per Acre				F.L.S. Missed Per Acre				% of Efficiency	
					R. Roez.	R. nevad.	R. iner.	Total	R. Roez.	R. nevad.	R. iner.	Total	By No. of Missed Bushes	By Amt. of Missed L.S.
SP-YP-Fir-Ribes Free	216.0	0	0	-	-	-	-	-	-	-	-	-	-	-
SP-YP-Fir	786.2	14.3	1.8	139.8	6.0	1.7	-	7.7	22.5	6.9	-	29.4	94.8	98.2
Brush	53.0	1.0	1.9	403.3	20.0	0	-	20.0	45.2	0	-	45.2	95.3	99.0
Stream	64.8	9.1	14.0	279.7	1.6	3.0	-	4.6	3.0	12.2	-	15.2	98.4	99.5
Totals	1,120.0	24.4	2.2	133.4	4.9	2.1	-	7.0	16.2	8.6	-	24.8	95.1	98.4

Average feet live stem in pulled bush 11.5.
Average feet live stem in missed bush 3.5.

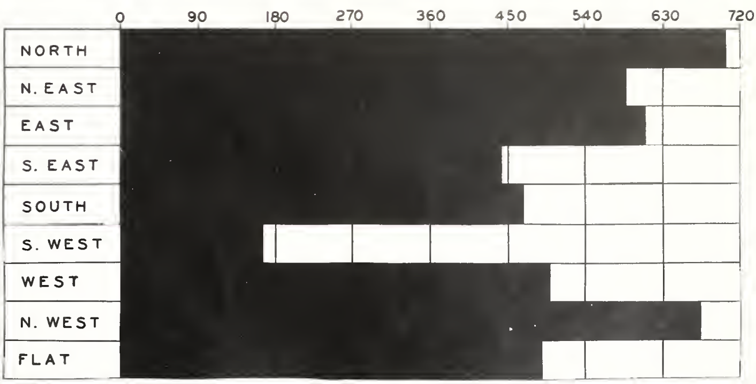
DISTRIBUTION BY SLOPE OF RIBES ROEZLI

Meadow Valley, Plumas National Forest, California.

Number Of Bushes Per Acre



Feet Of Live-Stem Per Acre

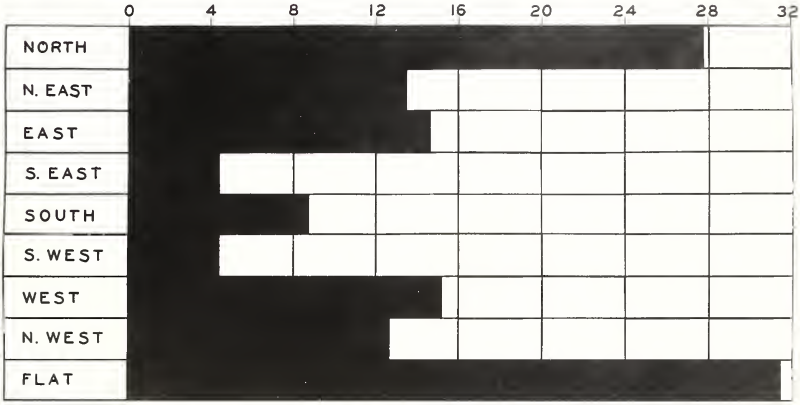


Annual Report, 1929
W. V. Benedict

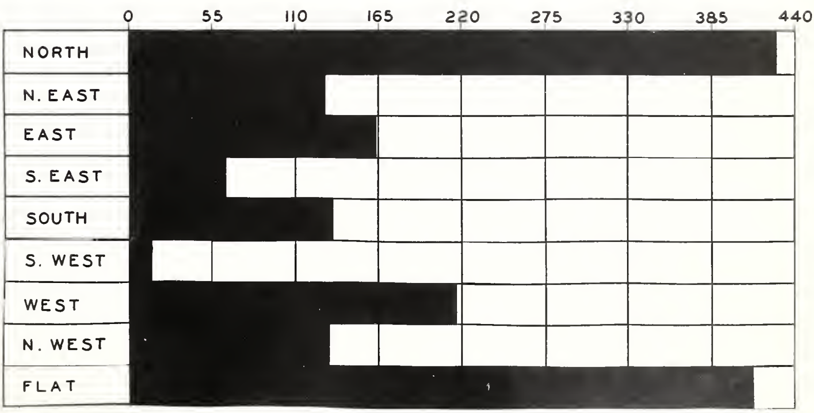
DISTRIBUTION BY SLOPE OF RIBES NEVADENSE

Meadow Valley, Plumas National Forest, California.

Number Of Bushes Per Acre



Feet Of Live-Stem Per Acre



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C. Pre-eradication

The pre-eradication work was done on the Rush Creek drainage (T. 26 N., R. 8 and 9 E.) of the Plumas National Forest.

The Rush Creek area constitutes the largest unbroken sugar pine stand of the Plumas Forest. It is somewhat inaccessibly located, 10 miles west of Greenville, California at an elevation of 5000-6000 feet. Timber species associated with sugar pine are white fir, red fir, Douglas fir, Jeffrey pine, lodgepole pine, yellow pine and incense cedar. White and red fir reproduction is abundant on parts of the area. Brush is heavy over much of the area, especially Ceanothus cordulatus. Ribes are abundant over the largest part of the area. The four species of Ribes present, in the order of their abundance are; R. Roezli, R. viscosissimum (hallii), R. inerme and R. nevadense.

The following table shows the results of the pre-eradication, according to eradication classes, on the 3200 acres worked:

TABLE NO. 13

RESULTS OF PRE-ERADICATION, RUSH CREEK

Eradication Class	Acres in Sec. 12	Acres in Sec. 13	Acres in Sec. 7	Acres in Sec. 18	Acres in $N\frac{1}{2}$ Sec. 19	Acres in $N\frac{1}{2}$ Sec. 26	Total Acres	% of Total
A	111.3	23.7	259.8	216.3	140.2	56.0	807.3	25.2
B	231.7	236.2	211.8	160.0	83.8	120.0	1,043.5	32.6
C	204.8	280.3	132.5	231.7	88.0	128.0	1,065.3	33.3
D	92.2	98.8	31.2	32.0	8.0	16.0	278.2	8.7
E	0	1.0	4.7	0	0	0	5.7	0.2
Total	640	640	640	640	320	320	3,200.0	100

COST OF OPERATION

A. Eradication Costs

All costs incurred by the project, properly chargeable against the field work, are included in the following table, which is the basis for all cost computations. Costs per acre for the different types and classes were figured on the basis of number of man-days of work spent on each type and class:

TABLE NO. 14

ERADICATION COSTS

Item	Camp 1 Amount	Camp 1 % of Total	Camp 2 Amount	Camp 2 % of Total	Both Camps Amount	Both Camps % of Total
Salaries	$5,216.98	58.2	$2,209.17	56.9	$ 7,426.15	57.8
Subsistence	2,845.84	31.8	1,297.35	33.4	4,143.19	32.3
Equipment	496.08	5.6	207.58	5.3	703.66	5.5
Supplies	73.04	.8	30.56	.8	103.60	.8
Twine	73.21	.8	30.64	.8	103.85	.8
Transp. of Men	21.87	.2	9.15	.2	31.02	.2
" " Equip.	34.43	.4	14.40	.4	48.83	.4
Miscellaneous	52.11	.6	21.81	.6	73.92	.6
Pre-erad. Charges	145.19	1.6	60.75	1.6	205.94	1.6
Total	$8,958.75	100	$3,881.41	100	$12,840.16	100
Minus Visitors Meal Deduction*	$ 54.17		$ 26.94		$ 81.11	
Net Total Cost	$8,904.58		$3,854.47		$12,759.05	

*138 meals were served to Forest Service, State, Blister-Rust Officials and other visitors.

B. Checking Costs

(1) Salaries. $176.47
(2) Meals. 63.34
Total $239.81 or $0.065 per acre.
Checking costs are included in eradication costs.

C. Pre-eradication Costs

(1) Salaries. $111.33
(2) Subsistence. 48.64
(3) Transportation. . 17.51
Total $177.48 or $0.05 per acre.

D. Meal Costs

TABLE NO. 15

COST OF MEALS

Item	Camp 1 Cost	Camp 1 % of Total	Camp 2 Cost	Camp 2 % of Total	Both Camps Cost	Both Camps % of Total
Cost of Supplies	$2,216.20	77.9	$ 962.55	74.2	$3,178.75	76.7
Transp. of Supplies	31.80	1.1	13.30	1.0	45.10	1.1
Cost of Cooking	597.84	21.0	321.50	24.8	919.34	22.2
Total	$2,845.84	100	$1,297.35	100	$4,143.19	100
No. Meals Served	6,387	-	2,718	-	9,105	-
Cost Per Meal	$ 0.445	-	$ 0.477	-	$ 0.455	-

CONCLUSION

The experimental Ribes eradication work on the Plumas Forest was not sufficiently extensive to provide average cost figures for the northern Sierra sugar pine region. Costs secured this year are higher than average because the eradication operation was centered in difficult working areas, and was terminated before adjoining areas, included in the original eradication program, could be worked. Pre-eradication and reconnaissance data indicate that additional eradication work would show a substantial decrease in the present per acre cost of Ribes eradication.

ERADICATION STUDIES - WOODS AND MILL PLOTS

By

W. V. Benedict,

Assistant Forest Pathologist.

In the spring of 1928 the California Forest Experiment Station inaugurated a comprehensive study of woods and mill operations on the Pickering Lumber Company sale area of the Stanislaus National Forest. The purpose of this study was primarily to establish a more definite correlation between the economic and silvicultural considerations involved in the management and utilization of timber stands in the California pine region.

Three contiguous 15-acre plots were established in the northeast quarter of section 28, township 4 north, range 18 east. Each plot was logged according to the following cutting practice:

Plot 1: Marked, cut and logged in accordance with standard District 5 Forest Service timber sale practice.

Plot 2: Cut and logged according to a heavy cutting system which removed merchantable material of all species to a low diameter limit.

Plot 3: Cut and logged in accordance with the practice recommended in an economic selective logging plan. This plan called for the leaving of practically all fir and cedar and the leaving of pine below a diameter limit of 30 inches.

The area on which the three plots are located was part of the area included in the experimental Ribes eradication program instituted by the Office of Blister Rust Control in 1926. An average of 30 Ribes per acre was eradicated from this area in August 1926.

Description of Area

The woods area, within which the plots are located, is on moderately sloping ground suitable for tractor logging. The elevation is approximately 5,800 feet.

The timber type is chiefly sugar pine-fir, with some yellow pine interspersed. The stand is all aged, about 80% mature and overmature and will cruise approximately 60,000 board feet to the acre.

Manzanita, spiny Ceanothus and scrubby chinquapin occur in considerable quantities on parts of the area where the timber stand has been opened by fire.

Purpose of Ribes Survey

The purpose of the Ribes survey of the area was two-fold: (1) To study the regeneration of Ribes on an area three years after the original eradication, and, (2) to study the effect of different methods of cutting and logging on Ribes establishment.

Work Done

The locations of all Ribes on each of the three plots were recorded so they can be plotted on the detailed cover map being prepared by members of the California Forest Experiment Station (copies of which are to be furnished this office). Each Ribes was recorded, by species, according to the following classification:

Missed bushes - Ribes not found by eradication crews in 1926.
Sprouted bushes - Ribes improperly eradicated by crews.
Seedlings - New bushes.

The height and feet of live stem were taken and the Ribes carefully eradicated.

These same data were also taken on a strip two chains wide around the outside of the three plots. Ribes on this outside strip were definitely located but not eradicated. This strip was logged by the same method as the plot which it adjoins.

A permanent 5-acre check plot was established on the adjoining northwest quarter of section 27 where Ribes eradication work had not been conducted. The height and amount of live stem, by species, were taken for all Ribes on this check plot.

Results of Work

TABLE NO. 1.

RIBES SURVEY AND ERADICATION, LOGGING AND MILL STUDY PLOTS, STANISLAUS FOREST, CALIFORNIA.

Method	Missed Bushes						Sprouting Bushes						Seedling Bushes						Total Bushes For Plot						Acres
	Live Stem Per Acre			Bushes Per Acre			Live Stem Per Acre			Bushes Per Acre			Live Stem Per Acre			Bushes Per Acre			Live Stem Per Acre			Bushes Per Acre			in
of Cutting and Logging	R. nev.	R. Roez.	Total	R. nev.	R. Roez.	Total	R. nev.	R. Roez.	Total	R. nev.	R. Roez.	Total	R. nev.	R. Roez.	Total	R. nev.	R. Roez.	Total	R. nev.	R. Roez.	Total	R. nev.	R. Roez.	Total	Plot
Plot No. 1. Forest Service	1.07	25.13	26.20	0.33	4.80	5.13	0	13.97	13.97	0	4.00	4.00	0.07	0.35	0.42	0.13	0.60	0.73	1.14	39.45	40.59	0.46	9.40	9.86	15
Plot No. 2. Heavy Cutting Method	0.23	18.38	18.61	0.13	3.40	3.53	0.20	14.46	14.66	0.20	4.50	4.70	0.11	0.70	0.81	0.13	1.20	1.33	0.54	33.54	34.08	0.46	9.10	9.56	15
Plot No. 3. Economic Cutting Method	0.83	15.16	15.99	0.27	2.00	2.27	0.13	7.05	7.18	0.13	1.67	1.80	0.13	0.53	0.66	0.13	0.33	0.46	1.09	22.74	23.83	0.53	4.00	4.53	15
Average Total Per Acre	0.71	19.57	20.28	0.24	3.40	3.64	0.16	12.16	12.32	0.11	3.38	3.49	0.10	0.53	0.63	0.13	0.71	0.84	0.97	32.27	33.24	0.49	7.49	7.98	45

Ribes plotted and eradicated.

TABLE NO. 2.

RIBES SURVEY OF A 2-CHAIN STRIP AROUND LOGGING AND MILL STUDY PLOTS.

Method	Missed Bushes						Sprouting Bushes						Seedling Bushes						Total Bushes For Plot						Acres
	Live Stem Per Acre			Bushes Per Acre			Live Stem Per Acre			Bushes Per Acre			Live Stem Per Acre			Bushes Per Acre			Live Stem Per Acre			Bushes Per Acre			in
of Cutting and Logging	R. nev.	R. Roez.	Total	R. nev.	R. Roez.	Total	R. nev.	R. Roez.	Total	R. nev.	R. Roez.	Total	R. nev.	R. Roez.	Total	R. nev.	R. Roez.	Total	R. nev.	R. Roez.	Total	R. nev.	R. Roez.	Total	Plot
Plot No. 1. Forest Service	0.40	82.26	82.66	0.13	13.01	*13.14	0	13.07	13.07	0	2.79	2.79	0	1.03	1.03	0	2.12	2.12	0.40	96.36	96.76	0.13	17.92	18.05	7.53
Plot No. 2. Heavy Cutting Method	0.92	44.31	45.23	0.38	3.72	4.10	0.90	36.67	37.57	0.38	18.59	**18.97	0	1.65	1.65	0	3.21	3.21	1.82	82.63	84.45	0.76	25.52	26.28	7.80
Plot No. 3. Economic Cutting Method	1.75	2.60	4.35	0.75	1.00	1.75	0	7.12	7.12	0	1.50	1.50	0.12	0.12	0.24	0.25	0.25	0.50	1.87	9.84	11.71	1.00	2.75	3.75	4.00
Average Total Per Acre	0.89	50.47	51.36	0.36	6.77	7.13	0.36	21.31	21.67	0.15	8.90	9.05	0.03	1.09	1.12	0.05	2.17	2.22	1.28	72.88	74.16	0.57	17.85	18.42	19.33

Ribes plotted. Not eradicated.

*A patch of missed bushes on an old burn - apparently overlooked in the original eradication.
**A patch of sprouting bushes; a wet slope where conditions for Ribes growth are ideal.
A heavy original stand of Ribes populated this area (a patch about 2 ch. sq.).

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TABLE NO. 3.

RIBES PER ACRE ON NON-ERADICATED AREA.

5-ACRE CHECK PLOT (NW$\frac{1}{4}$ of NW$\frac{1}{4}$ Sec.27).

Ribes Species	No. of Bushes Per Acre	Feet Live Stem Per Acre
R. nevadense	3.6	17.3
R. roezli	39.0	325.04
Total	42.6	342.34

The amount of live stem in the average bush on non-eradicated area was 8.3 feet for R. roezli and 4.8 feet for R. nevadense; and for the eradicated area 4.19 feet for R. roezli and 2.07 feet for R. nevadense.

Future Work

Periodic checks of the plots will be made to study the re-entry and establishment of Ribes. The cover map of each plot, on which will be shown the spot where each bush was eradicated, as well as the location of each bush in the two chain peripherial strip, in relation to the residual timber stand and brush patches, will materially help in making the study.

FURTHER PROGRESS IN THE DEVELOPMENT OF RIBICIDES

By

H. R. Offord, Agent

INTRODUCTION

The rapid spread of white pine blister rust in the pine regions of north Idaho, as determined by the Office of Blister Rust Control in the fall of 1928, showed the necessity of immediate eradication of susceptible Ribes which occur in close proximity to valuable white pine. More specifically, the rapid spread of the rust in Idaho called for the economic and effective eradication of Ribes petiolare and Grossularia inermis, the two most susceptible species growing in moist bottom lands throughout the range of white pine. The appearance of the rust on Ribes in the southern part of the pine stands was strong evidence that the rust was generally distributed over the white pine region of the Inland Empire. It seemed advisable, therefore, to apply methods of local control in those regions where most effective work could be done. Pursuant to these facts, plans were formulated for the eradication of large areas of R.petiolare occurring in the southern half of the white pine area of Idaho. For this work it was planned to use methods of chemical eradication which experimental studies of several years' duration had proved to be more effective and less costly than hand eradication. At the same time it was recognized that, as the work progressed northward, large areas of G.inermis would be encountered, the eradication of which would be extremely costly were it to be done by hand. As yet no suitable Ribicide had been devised for G.inermis.

The successful eradication of G.inermis, therefore, presented the key problem in the program of local control for the Idaho pine regions.

During the winter of 1928-29 a concerted drive along investigative lines was organized at the University of California, having as its immediate objective the development of a suitable Ribicide for G.inermis. Morphological work was undertaken by F. A. Patty with Mrs. Webber, Assistant in the Department of Botany, devoting part time to his assistance. A. S. Crafts, Assistant in the Division of Pomology, was secured for investigative work dealing specifically with the mechanism of the translocation of toxic chemicals by Ribes plants. The scope of the chemical work was increased with the aid of R. P. d'Urbal, G. R. Van Atta and N. T. Mirov as assistants. The combined program of chemical, morphological and physiological research was outlined in the writer's annual report for 1928. This report summarizes the work done in the laboratory during 1928-29, reports on 1929 field work in Idaho, California and Oregon, and tentatively outlines the research work to be undertaken in 1929-30.

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Titration curves of tannin extracts of R. petiolare and G. inermis with N hydrochloric acid and N sodium hydroxide showed that tannins contributed but little to the buffer system of the plant on the acid side and only slightly more on the alkaline side. Water extracts made from dried leaves and stems of Ribes were studied as precipitants of a large number of spray solutions that had been tested out previously in the field. In general, those chemicals which had proved to be most effective under field conditions gave smaller precipitates with the water extractives than the non-effective chemicals. A study of heavy metal complexes (which did not form precipitates with Ribes water extractives) was undertaken, and as a result several new compounds were developed, which, under greenhouse conditions, proved to be very effective on G. inermis and R. lacustre. Of the compounds tested copper cyanide tetrasodiumthiosulphate gave by far the best results. Commercial methods were worked out for the manufacture of the new complex (heretofore designated as X). Glycerine, glucose and refuse molasses were established as spreaders and binders of the complex. Studies of the buffer action and dissociation constant of the complex were pursued as a guide to further research in the field of complex salts of heavy metals.

Careful experiments in which the stems and soil surface of pots were protected showed that sodium chlorate was present in the stems after 2-6 hours and in the roots in 5-7 days following application of spray. Tests were made colorimetrically with indigo sulphate and urine, following extraction of the sodium chlorate from the plant tissue by a special method of dialysis. These experiments prove conclusively that sodium chlorate, as such, moves within the tissue of the plant. These tests were made on G. roezli, R. viscosissimum and R. petiolare.

Ignition temperatures of dry Ribes leaves previously sprayed with sodium chlorate ranged from 140 to 270 deg. C. Tests were performed in air dried by passing through sulphuric acid. Spontaneous combustion of cloth soaked in chlorate occurred at 121 deg. C.

Experiments in waterproofing and fireproofing cloth to render the cloth less inflammable established a combined process involving the application of stannic oxide to the fibre and precipitation of gilsonite as a waterproofing substance with the aid of benzene as a carrier.

A study of the toxicity of the various chlorates when applied to Ribes in the greenhouse arranged the chlorates in a descending order of effectiveness given as follows: magnesium, sodium, iron, calcium barium. Magnesium chloride was suggested as a hygroscopic agent superior to calcium chloride on the basis of increased toxicity. This suggestion was withdrawn at the end of the field season after experiments showed that the magnesium mixture was much more unstable than the calcium and as a result more susceptible to spontaneous combustion.

Titration curves of tannin extracts of R. petiolare and R. inerme with N hydrochloric acid and N sodium hydroxide showed that tannins contributed but little to the buffer system of the plant on the acid side and only slightly more on the alkaline side. Water extracts made from dried leaves and stems of Ribes were studied as precipitants of a large number of spray solutions that had been tested out previously in the field. In general, those chemicals which had proved to be most effective under field conditions gave smaller precipitates with the water extractives than the non-effective chemicals. A study of heavy metal complexes (which did not form precipitates with Ribes water extractives) was undertaken, and as a result several new compounds were developed, which, under greenhouse conditions, proved to be very effective on R. inermis and R. lacustre. Of the compounds tested copper cyanide tetrasodiumthiosulphate gave by far the best results. Commercial methods were worked out for the manufacture of the new complex (heretofore designated as C). Glycerine, glucose and refuse molasses were established as spreaders and binders of the complex. Studies of the buffer action and dissociation constants of the complex were pursued as a guide to further research in the field of complex salts of heavy metals.

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SUMMARY OF RESEARCH WORK, 1928-1929

Propagation of Ribes Under Greenhouse Conditions.

Seedlings and stem cuttings of R. petiolare, R. lacustre, G. inermis and R. viscosissimum were placed in flat boxes containing river sand and kept in a cool place out of doors for a period of two weeks. After this period of hardening, seedlings and stem cuttings showed new roots and were ready for the greenhouse. Sand and water cultures were used for both stem cuttings and seedlings. Half and quarter Hoafland nutrient solutions were used for the water cultures and quarter Hoagland was added to Oakley Blow, a special California sand, for sand culture propagation. R. petiolare made particularly good growth on the quarter strength water cultures. Sand culture material grew slowly but appeared normal in every respect. Overhead artificial illumination was commenced on the first of December and continued for the next three months. The additional light was given over the period 5:00 p.m. to 11:00 p.m. Both sand and water cultures responded quickly to the increased illumination. Red spider and mildew continue to be the chief greenhouse pests, best control of the former being accomplished by napthalene fumigation and of the latter by application of sulphur on warm, bright days. Ants and the associated mealy bug were checked satisfactorily by a judicious handling of small cans of the commercial ant poison. Considerable Ribes material that had been placed in cold storage (0 degree C. room) September 15 was started on water culture in the greenhouse about the middle of January with very satisfactory results.

The result of the past season's greenhouse experience was to further enhance the water culture as a medium for the propagation of Ribes under greenhouse conditions. Ease of handling, economy of space, and more satisfactory growth are apparent in the case of the water culture method. Experience also showed (1) the advisability of increasing the length of the short dark days by artificial illumination; (2) the importance of keeping the temperature of the nutrient solution about 18 degrees C.; (3) desirability of excluding light from the culture jars; (4) the necessity for proper aeration of the nutrient solutions. For next winter's work it is planned to control more completely the above-mentioned points.

Chemical Work.

Proximate analysis of leaves and stems of Idaho Ribes gathered in early May and pickled in alcohol was completed. Differences were observed in tannin, reducing sugar, suberin-cutin, and lignin content of the leaves and stems of the four Ribes. Samples of dried leaves of G. inermis and R. petiolare collected late in the fall showed a higher tannin content than the spring collection in the case of R. petiolare and an equal amount in the case of G. inermis. Wilson and Kern's method gave about half the amount of tannin given by The Official Method.

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Galvanized spraying equipment is satisfactorily protected from the slightly corrosive action of the X sprays by applying a coat of asphalten paint thinned with benzene.

Physiological Work.

Examination of plots at Leland Meadow showed diminution of stored starch of sprayed R. nevadense and G. roezli. Cutting Ribes stem under eosin solutions showed rather a large water deficit as indicated by a rapid downward movement of eosin.

Experiments performed with cut stems of Ribes (R. glutinosum and G. leptosma gathered from Berkeley hills) showed that gooseberries were probably more susceptible than currants when chlorate is taken in through the xylem. G. leptosma was injured by 1% and 2% solutions of sodium chlorate. Sufficient chlorate was absorbed by both currant and gooseberry in 15 minutes from a 12½% solution of chlorate to kill the old leaves. After 40 hours all cut shoots were killed. Cut morning glory shoots absorbed .05% of their green weight in 15 minutes, a quantity sufficient to kill. Ribes were affected somewhat quicker than this.

A comparison was made of the toxic action of sodium chlorate and arsenious oxide on Ribes and morning glory. Chlorate was found to be just as toxic as arsenic when introduced into the Xylem elements. Chlorate injured the young tissue more slowly than the old tissue and killed both leaves and stems with a minimum of discoloration of the tissue. On the other hand, arsenic killed the old and young leaves with equal facility, turned the leaves quite brown, and allowed the stems to remain green except for the longest exposures.

Plasmolysis experiments were undertaken using Tradescantia cells, in which a comparison was made of isotonic solutions of sugar (.20 - .25 M), potassium nitrate (.12 - .16 M), and sodium chlorate (.08 - .12 M). Cells immersed in sugar and sodium chlorate showed little recovery. In nitrate solutions cells started to recover after 7 hours. Sodium chlorate showed injury in .08 M or greater after $2\frac{1}{2}$ hours by the outward diffusion of the cell contents. Further studies on Tradescantia showed that sodium chlorate has a low coefficient of permeability with respect to protoplasm, an observation born out by the work with Nitella. The toxicity of sodium chlorate, sugar and arsenious oxide was then studied in the light of permeability coefficients. Tradescantia cells slightly plasmolysed by sugar recovered in a few days. Arsenic browned the nucleii after 24 hours, precipitated the protoplasm and rendered the cells more permeable as shown by subseqnent plasmolysis with sugar solutions. Sodium chlorate browned the nucleii after 30-36 hours, coagulated with protoplast and the plasmolysis allowed no recovery on the part of the treated cells.

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A study of the acid injury of leaves of G. inermis and R. petiolare indicated that R. petiolare was more susceptible to acid injury than G. inermis and that in both cases penetration took place through the lower leaf surface quicker than through the upper leaf surface. Acid injury showed diffusion across thinly cutinized leaf portions or across breaks in leaf cuticle. Further studies of the penetration of acid, alkali and neutral color reagents, and sodium chlorate, into Ribes leaves confirmed the observation that penetration occurred across thinly cutinized portions of the leaf. The variability of individual plants of the different species was illustrated conclusively. It was also observed that the constituents of the leaves were able to remove quantities of the chemical involved in the penetration.

The importance of the so-called water extractives had been pointed out by chemical experiments and further physiological experiments were conducted with this point in mind. Dekkers experiments with tin foil and gelatin-covered leaves were repeated, using several sets of leaves from different positions on a number of plants. After 48 hours under artificial illumination the leaves were stained in bichromate solution and in every case the gelatin-covered and uncovered leaves were darker (showing the presence of more tannins) than the tin-foil-covered leaves.

A confirmation of the chemical theory of the importance of the extractives and their power of precipitating simple salts was obtained in the following experiment. The petioles of R. petiolare and G. inermis were cut and the ends allowed to dip into solutions of silver nitrate and a complex of silver nitrate and sodium thiosulphate. After a few hours the leaves were cleared with chloral hydrate and alcohol and placed in a developer. The complex solution allowed an even distribution through all small veins while the silver nitrate penetrated only half way along the main ribs. The same observation was made with the complex X when hydrogen sulphide was used to precipitate the copper "in situ". Starch was not depleted by dipping cut shoots of Ribes in chlorate solutions but the tannins showed a decrease as suggested by staining reaction with potassium dichromate.

Eosin solutions were used to follow the movement of water through the leaves of R. petiolare and G. inermis, and showed rapid movement through the xylem to the part of the plant where it is called by reason of the transpiration gradient.

A study of the toxicity made by placing cut stems in solutions of complex showed that it was of the same order of magnitude as arsenic and chlorate. A number of Ribes sprayed in the median portion and having the upper and lower leaves protected from contamination by the chemical, showed injury to the upper and lower leaves after a period of three weeks. This suggested that the complex X moved slowly through the phloem tissue. Penetration of the complex X is much slower than sodium chlorate due possibly to the much larger molecule.

A study of the acid injury of leaves of *R. inermis* and *R. petiolare* indicated that *R. petiolare* was more susceptible to acid injury than *R. inermis* and that in both cases penetration took place through the lower leaf surface quicker than through the upper leaf surface. Acid injury showed diffusion across thinly cutinized leaf portions or across breaks in leaf cuticle. Further studies of the penetration of acid, alkali and neutral color reagents, and sodium chlorate, into Ribes leaves confirmed the observation that penetration occurred across thinly cutinized portions of the leaf. The variability of individual plants of the different species was illustrated conclusively. It was also observed that the constituents of the leaves were able to remove quantities of the chemical involved in the penetration.

The importance of the so-called water extractives had been pointed out by chemical experiments and further physiological experiments were conducted with this point in mind. Dekkers experiments with tin foil and gelatin-covered leaves were repeated, using several sets of leaves from different positions on a number of plants. After 48 hours under artificial illumination the leaves were stained in dichromate solution and in every case the gelatin-covered and uncovered leaves were darker (showing the presence of more tannins) than the tin-foil-covered leaves.

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Morphological Work.

In July of 1928, leaves and stems of R.petiolare, R.lacustre, R.viscosissimum and G.inermis were collected from bushes growing on average site conditions and pickled in acetic-formalin-alcohol solution. A complete series of paraffin sections of leaves and petioles of all four species was made as well as a few sections of dormant winter buds. Leaves and stems were cut into small sections and placed in diaphanal for about a month to demineralize the tissue; embedded in paraffin; cut into sections ten microns thick; stained in Delafields Haematoxlyn and mounted on permanent slides in Canada balsam. Sudan III dissolved in alcohol and glycerine was used to differentiate the suberized and cutinized cells of the leaf epidermis. Commercial Chlorox was used to extract the coloring matter in the leaves so that the venation could be studied. Free hand sections of greenhouse Ribes were stained with potassium dichromate to study the distribution of the tannins.

Due to the fact that the material collected did not represent comparable ecological forms the differences observed may have been caused by the particular site environment in which the bush from which the sample was collected happened to be growing. There appears to be no striking difference in the structure of the four species examined which could account for a difference in susceptibility to chemical treatment. The following points were suggested by the first examination of material, however, and if subsequent examination of ecological forms confirms these differences, may have bearing on the problem; (1) a cutinized layer from six to nine microns in thickness protects the upper surface of the leaves of all species. The lower surface has a very thin layer of cuticle about one micron thick. The upper surface of R.petiolare in the shade form has very poor protection, the thickness of the cuticle being only one micron. The pore walls of the stomata are cutinized. (2) Crystals of calcium oxalate are found in the palisade cells of G.inermis while in the other species the crystals are in the spongy parenchyma. (3) The glands on the under leaf surface are distinctive for each species and the species can be determined thereby. (4) The air spaces of R.lacustre and G.inermis make up a greater part of the mesophyll below the palisade layer. On the other hand intercellular spaces of R.petiolare and R.viscosissimum are smaller and the cells of the spongy parenchyma are more compact. These conditions are to be expected, for a correlation probably exists between the frequency of the air spaces and the frequency of the stomata. R.lacustre and G.inermis have an average stomatal count of about 88 per square mm. and the other two species about 150 per square mm. (5) The vascular systems of the petiole are independent of each other after they leave the stem.

Free hand sections of leaves and stems taken from greenhouse Ribes and stained for tannins with potassium dichromate showed considerable variation of tannin between individuals as well as between species. Material which had been pickled in alcohol for some time (4 months) showed

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much less tannin in R.petiolare than in G.inermis and R.lacustre. This observation was in keeping with the chemical fact previously ascertained, in effect, that R.petiolare differed from the other species in the ratio of alcohol-soluble to water-soluble tannins. Fresh Ribes leaves taken from the plants following several cloudy days were much lower in tannin content than the field samples first tested. After two sunny days R.lacustre showed an increase in the amount of tannin as indicated by the dichromate staining reaction. In order to test the action of light on the production of tannins, Ribes were placed in a dark box for 24 and 72 hours respectively, and then compared with plants growing under artificial illumination. No great difference was observed between the quantities of tannins present in the two cases for the leaves. The stem sections of plants which had been left in the dark showed some disappearance of tannin from the pith, particularly, R.petiolare. G.inermis, judging from the intensity of the color, had more tannin following the dark box treatment. These results are at variance with results obtained by repeating Dekkers experiments which definitely showed lighter staining reactions with potassium dichromate in the case of the tin-foil-covered leaves than the gelatin-covered leaves and controls.

Significance of Research Work in Terms of Field Experiments.

Field experiments performed during 1924, 1925, 1926 and 1927 exhaustively explored the list of known herbicides and proved conclusively that any progress in the search for a suitable Ribicide must, perforce, result from (1) an intimate knowledge of the life and habits of the several Ribes with which chemical eradication was concerned and (2) the reactions of those Ribes to the sprays applied. Keeping these thoughts in mind the research work of the winter preceding each field season has, for the past three years, provided a basis for the field tests. Owing to the time factor involved in the securing of data from field experiemts, and in consideration of the short period during which it is possible to make those tests, it has been thought advisable to interpret rather liberally the facts determined by laboratory work; in this respect many of the field experiments are still empirical. Each experiment, however, is a part of the development plan and contributes information, the sum total of which is used as a starting point for the following winter's research work.

The enlarged program of investigative work undertaken during the winter 1928-29 has contributed valuable information which has been of immediate practical value in the field. Chemical, physiological and morphological research showed that toxic compounds having certain chemical properties are translocated by the plant in natural metabolic processes, or are able to diffuse to considerable extent in plant tissue without being immediately acted upon by chemical constituents of the plant. Complex salts of heavy metals stable over a pH range of 4-10 are apparently able to move within the plant in the manner suggested.

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Furthermore a shorthand method of testing the proposed Ribicide as a precipitant of tannin-like bodies gives promise of providing a barometer of toxicity. The idea is entirely new in the field of plant poisons and opens up a vista of complex salts (organic and inorganic) that had endless possibilities. Application for a public service patent covering the use of complex salts of heavy metals has been made.

A combination fireproofing and waterproofing method for textiles has been devised. This process is designed to afford protection against the spontaneous combustion of clothing worn by persons engaged in spraying chlorates and to reduce the rapidity with which cloth soaked in chlorate will burn following ignition. This process was used to treat the trousers of chemical eradicators during the past summer and was instrumental in providing a summer free from accidents.

Magnesium chlorate in place of sodium or calcium chlorate has been suggested by investigative work as well as magnesium chloride as a hygroscopic agent in place of calcium chloride. Refuse molasses and glucose syrup showed promise as stickers and binders of the complex salts of heavy metals. Glycerine is most satisfactory for this purpose but in view of its cost further search is planned. The so-called "X" and "Y" sprays listed in the 1929 spray summary for Idaho, Oregon and California are specific formulae devised from the results of laboratory work.

SUMMARY OF FIELD WORK

Results of 1928 Tests of Ribicides Applied in Idaho, California and Oregon.

Experimental plots at Santa, Idaho were checked carefully by the usual method of ocular estimate during the latter part of May and at intervals during the month of June by Haring, Crafts and the writer. Results of the recheck are tabulated in Table 1.

Furthermore a short-cut method of testing the proposed chlorate as a precipitant of tannin-like bodies gives promise of providing a barometer of toxicity. The idea is entirely new in the field of plant poisons and opens up a vista of complex salts (organic and inorganic) that had endless possibilities. Application for a public service patent covering the use of complex salts of heavy metals has been made.

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SUMMARY OF FIELD WORK

Results of 1928 Tests of Chlorates Applied in Idaho, California and Oregon.

Experimental plots at Santa, Idaho were checked carefully by the usual method of ocular estimate during the latter part of July and at intervals during the month of June by Darling, [illegible] and [illegible]. Results of the recheck are tabulated in Table I.

TABLE NO. 1

RESULTS OF 1928 EXPERIMENTAL SPRAYING AT SANTA, IDAHO
DATA TAKEN 1929

Date of Application	Plot Number	Chemical Used	Concentration Lbs. Per Gal. H_2O (2)	pH of Spray	Gallons Spray Used	At Time of Application: Average Soil Temperature 7 a.m. to 5 p.m. Deg. F.	At Time of Application: Average Relative Humidity 7 a.m. to 5 p.m.	At Time of Application: Weather Log	R. petiolare: Live Stem Killed Per Cent	R. petiolare: Bushes Killed Per Cent	R. petiolare: Bushes Treated Number	R. lacustre: Live Stem Killed Per Cent	R. lacustre: Bushes Killed Per Cent	R. lacustre: Bushes Treated Number	G. inermis: Live Stem Killed Per Cent	G. inermis: Bushes Killed Per Cent	G. inermis: Bushes Treated Number	R. viscosissimum: Live Stem Killed Per Cent	R. viscosissimum: Bushes Killed Per Cent	R. viscosissimum: Bushes Treated Number
6/7/28	VI A (5-5.7)	A (1)	2.70	6.8	10	51	55	Cloudy with wind.			0			(3)			(3)			0
6/9/28	VI A (5.7-6)	A	3.40	6.8	5	54	49	Warm. Clear.			0	99	91	11	99	72	32			0
6/9/28	VI B (5-5.4)	A + Calcium chloride	3.40 2.30	9	5	54	49	Warm. Clear.			0			(3)			(3)			0
6/9/28	VI B (5.4-5.7)	A + Calcium chloride	2.70 2.00	9	5	54	49	Warm. Clear.			0			(3)			(3)			0
6/14/28	VI B (5.7-6)	A + Calcium chloride	2.00 1.40	9	6	51	51	Warm. Clear.			0	97	69	48	91	52	31			0
6/14/28	VI A (6-6.6)	A + Sodium hydroxide	3.40 0.08		15	51	51	Warm. Clear.			0	99	88	34	96	53	77			0
6/16/28	VI B (6-6.6)	Sodium hypochlorite	Full Strength		9	52	57	Slight rain in a.m. Cool and cloudy in p.m.			0	72	9	51	68	4	40			0
6/16/28	VI A (4-4.4)	A + Manganese chloride	3.40 0.008	6.8	5	55	72	Cloudy with wind.			0	100	100	41	99	97	31			0
6/25/28	VI A (4.4-5)	Sodium hypochlorite	½ Strength		6	58	57	Warm and cloudy.			0	46	4	48	57	15	55			0
6/26/28	VI B (4-5)	A + Sodium hypochlorite	1.40 6 Gallons ½ Strength		10	58	57	Warm and cloudy.			0	90	63	99	85	43	65			0
6/26/28	Ex. 1	A	0.89	6.8	2	58	57	Warm and cloudy.	100	100	4			0			0			0
6/26/28	I A (0-0.5)	A + Sodium hypochlorite	2.00 5 Gallons 1/3 Strength		10.5						0	98	91	63	92	45	74			0
6/26/28	I A (0.5-0.95)	A + Sodium hypochlorite	2.00 5 Gallons ½ Strength		7.5	58	57	Warm and cloudy.			0	99	96	51	94	58	87			0
6/27/28	I A (2-2.7)	A + Furfural	2.00 0.42		13	59	87	Cool in a.m. Heavy rain 3:30 p.m.			0	99	90	21	82	43	119			0
6/27/28	VII A (0-.65)	A	2.00	6.8	9	59	87	Cool in a.m. Heavy rain 3:30 p.m.			0			0			0	99	96	131
6/28/28	VII A (.65-1)	A	2.70	6.8	4.5	59	71	Cool and cloudy.			0			0			0	99	92	137
7/9/28	I A (4-5)	A + Sodium hydroxide	2.70 0.16		14	57	47	Fine. Warm. Clear.			0	99	93	55	95	59	117			0
7/10/28	I A (3-4)	A + Sodium hydroxide	2.00 0.16		10	56	50	Fine. Warm. Clear.			0	99	92	25	94	56	68			0
7/10/28	1 A (2.7-3)	A + Furfural	2.00 0.16		7	56	50	Fine. Warm. Clear.			0	99	93	29	88	41	57			0
7/11/28	I B (2.7-3)	A + Furfural	2.00 0.08		18	58	51	Fine. Warm. Clear.			0			Data to be taken 1930			Data to be taken 1930			0
7/12/28	VI A (2-2.4)	A + Sodium hydroxide	2.00 0.32		5	59	54	Fine. Warm. Clear.			0	99	91	33	87	47	82			0
7/16/28	VII A (1-1.4)	A	3.40	6.8	7	63	53	Fine. Warm. Clear.			0			0			0	100	100	169
7/16/28	VII A (1.4-2)	A	1.40	6.8	5	63	53	Fine. Warm. Clear.			0			0			0	98	97	137
7/16/28	VII A (2-3)	A + Calcium chloride	2.70 0.89	9	5.5	63	53	Fine. Warm. Clear.			0			0			0	98	97	258
7/16/28	VII B (0-1)	A + Calcium chloride	2.70 1.20	9	8	63	53	Fine. Warm. Clear.			0			0			0	96	91	192
7/17/28	VI A (2.4-3)	A + Manganese chloride	3.40 0.016	6.8	9	67	61	Warm. Cloudy. Rain late p.m.			0	99	91	68	87	55	73			0
7/17/28	VI A (3-3.65)	A + Manganese chloride	3.40 0.08	6.8	5	57	61	Warm. Cloudy. Rain late p.m.			0	99	93	53	86	59	90			0
7/16/28	VI A (3.65-4)	A + Iron chloride	3.40 0.008	6.8	5.5	62	63	Warm. Cloudy. Rain late p.m.			0	95	93	40	92	54	73			0
7/21/28	VII A (3-4)	A + Calcium chloride	2.70 2.00	9	6.5	61	47	Clear. Hot.			0			0			0	97	92	122
7/21/28	VII B (1-1.45)	A + Ammonium chloride	2.70 0.89	5	5	61	47	Clear. Hot.			0			0			0	97	96	51
7/21/28	I B (5-5.5)	A + Iron chloride	3.40 0.016	6.8	5	61	47	Clear. Hot.			0			Plot Missed			Plot Missed			0
7/21/28	VII B (1.45-2)	A + Ammonium chloride	2.70 1.14	5	5	61	47	Clear. Hot.			0			0			0	100	100	55
7/23/28	I B (5.5-6)	A + Iron chloride	3.40 0.08	6.8	10	63	42	Clear. Hot.			0	100	100	1	95	52	58			0
7/24/28	I B (6-6.6)	A + Sodium dichromate	1.40 0.42		10	65	39	Clear. Hot.			0	83	20	5	70	17	47			0
7/25/28	II A (5-6)	A + Sodium dichromate	2.00 0.42		7.5	63	33	Clear. Hot.			0	100	100	3	92	31	80			0
7/25/28	II A (6-6.6)	A + Sodium dichromate	3.40 0.16		5	63	33	Clear. Hot.			0	100	100	1	94	59	44			0
7/26/28	II B (3-4)	A + Potassium permanganate	1.40 0.42		6	65	36	Clear. Hot.			0			0	95	42	41			0
7/27/28	II A (3-4)	A + Potassium permanganate	2.00 0.42		7	67		Warm. Cloudy.			0	100	100	1	93	36	85			0
7/28/28	VII B (2-2.4)	A	2.70	2	5	67		Clear. Warm.			0			0			0	99	97	94
7/28/28	VII B (2.4-3)	A + Ammonium chloride	2.70 1.40	5	5	67		Clear. Warm.			0			0			0			Plot Missed
7/28/28	VII B (3-3.4)	A	2.70	12	5	67		Clear. Warm.			0			0			0			Plot Missed
7/31/28	III A (0-.5)	A + Furfural	1.40 0.08		10	66		Clear. Warm.			0			0	70	13	63			0
8/1/28	III A (.5-1)	A + Furfural	1.40 0.16		12	58		Cool. Cloudy.			0			0	78	23	85			0
8/1/28	III B (5-6)	A + Potassium permanganate	3.40 0.16		6	58		Cool. Cloudy.			0			0	82	64	80			0
8/2/28	III A (1-1.5)	A + Furfural	1.40 0.42		5	58		Warm. Cloudy.			0			0	68	10	49			0
8/2/28	III A (1.5-2)	A + Phenol	2.00 0.008		5.5	58		Warm. Cloudy.			0			0	79	30	51			0

(1) Symbol for sodium chlorate.
(2) Concentration of chemical expressed in this report as pounds per gallon instead of per cent by weight as in 1928 report.
(3) Plots burned over in fall of 1928 by men clearing brush.

(Continued on next page.)

TABLE NO. 1 (Continued)

RESULTS OF 1928 EXPERIMENTAL SPRAYING AT SANTA, IDAHO
DATA TAKEN IN 1929

Date of Application	Plot Number	Chemical Used	Concentration Lbs. Per Gal. H_2O (2)	pH of Spray	Gallons Spray Used	At the Time of Application: Average Soil Temperature 7 a.m. to 5 p.m. Deg. F.	At the Time of Application: Average Relative Humidity 7 a.m. to 5 p.m.	At the Time of Application: Weather Log	R. petiolare: Live Stem Killed Per Cent	R. petiolare: Bushes Killed Per Cent	R. petiolare: Bushes Treated Number	R. lacustre: Live Stem Killed Per Cent	R. lacustre: Bushes Killed Per Cent	R. lacustre: Bushes Treated Number	G. inermis: Live Stem Killed Per Cent	G. inermis: Bushes Killed Per Cent	G. inermis: Bushes Treated Number
8/4/28	III B (0-1)	A (1) + Phenol	3.40 0.008		8	58		Warm. Clear.			0			0	80	34	113
8/6/28	IV A (3-4)	A + Sodium tetraborate	1.40 0.42		5.5	58		Warm. Clear.			0	100	100	1	65	10	73
8/6/28	IV A (2-3)	A + Sodium tetraborate	2.70 0.42		7	58		Warm. Clear.			0	100	100	1	47	24	119
8/6/28	III B (1-1.3)	A + Sodium tetraborate	3.40 0.16		5	58		Warm. Clear.			0			0	88	39	38
8/7/28	III B (1.3-2)	Furfural	0.42		7.5	57		Warm. Clear.			0	75	50	2	12	2	68
8/7/28	Ex. 2	A	1.40	6.8	2	57		Warm. Clear.	100	100	12			0			0
8/7/28	Ex. 3	A	2.00	6.8	2	57		Warm. Clear.	100	100	7			0			0
8/7/28	Ex. 4	A + Sodium dichromate	1.40 0.16		1.5	57		Warm. Clear.	100	100	6			0			0
8/8/28	Ex. 5	A + Sodium dichromate	1.40 0.42		1.5	58		Warm. Clear.	100	100	10			0			0
8/8/28	Ex. 6	A + Potassium permanganate	1.40 0.16		1.5	58		Warm. Clear.	100	100	7			0			0
8/8/28	Ex. 7	A + Potassium permanganate	1.40 0.42		2	58		Warm. Clear.	98	90	10			0			0
8/8/28	Ex. 8	A + Ammonium chloride	2.00 0.89	5	1.5	58		Warm. Clear.	100	100	5			0			0
8/8/28	Ex. 9	A + Ammonium chloride	0.89 0.42	5	2	58		Warm. Clear.	100	100	7			0			0
8/9/28	Ex. 10	Furfural	0.42		2	59		Warm. Clear.	5	0	13			0			0
8/9/28	II A (1-2)	Phenol	0.06		6	59		Warm. Clear.			0	7	0	2	10	0	144
8/10/28	II A (2-3)	Phenol	0.42		5.5	58		Warm. Cloudy.			0	47	3	0	21	2	167
8/14/28	VIII A (0-1)	A + Calcium chloride	2.70 1.20	6.8	5.5	55		Warm. Cloudy.			0		Data to be taken 1930				Data to be taken 1930
8/14/28	VIII A (1-2)	A + Calcium chloride	2.70 0.89	6.8	7	55		Warm. Cloudy.			0		Data to be taken 1930				Data to be taken 1930
8/14/28	VIII A (2-3)	A	2.00	6.8	5	55		Warm. Cloudy.			0	99	0	1	85	29	74
8/15/28	VIII A (3-4)	A	1.40	6.8	5	55		First frost in early a.m. Warm. Cloudy.			0			0	75	23	64
8/16/28	Ex. 11	A	0.89	2	8	51		Warm. Clear.	99	96	23			0			0
8/16/26	Ex. 12	A	0.89	12	7	51		Warm. Clear.	98	94	20			0			0
8/17/28	Ex. 13	A	2.70	6.8	5	51		Warm. Clear.			0			0	80	40	G. irrigua 15
6/17/28	Ex. 14	A	0.65	6.8	3	50		Warm. Clear.	100	100	12			0			0
8/17/28	Ex. 15	A	0.42	6.8	2	50		Warm. Clear.	99	90	10			0			0
8/17/28	Ex. 16	Potassium chlorate	0.42	2	5	50		Warm. Clear.	97	85	6	45	30	12	25	0	5
8/17/28	Ex. 17	Potassium chlorate	0.42	6.8	4	50		Warm. Clear.	99	80	5	40	10	10			0
8/18/28	VIII A (4-5)	A	3.40	2	8	52		Warm. Clear.			0	84	29	7	57	24	101
8/18/28	Ex. 18	A	2.00	2	1.5	52		Warm. Clear.	100	100	4			0			0
8/20/28	VIII A (5-5.65)	A	3.40	12	5	51		Warm. Clear.			0			0	71	27	71
8/20/28	VIII A (5.65-6)	A	2.00	2	4.5	51		Warm. Clear.			0			0	48	10	49
8/20/28	VIII A (6-6.6)	A	2.00	12	6.5	51		Warm. Clear.			0	66	0	1	59	18	86
8/22/28	VIII B (0-1)	A	1.40	2	6.5	54		Warm. Clear.			0			0	48	5	155
8/22/28	VIII B (1-1.4)	A	1.40	12	5	54		Warm. Clear.			0			0	47	6	38
8/22/28	VIII B (1.4-2)	A + Calcium chloride	2.70 0.89	2	5	54		Warm. Clear.			0			0	64	25	35
8/23/28	VIII B (2-3)	A + Calcium chloride	2.70 0.89	10	5	55	50	Warm. Cloudy.			0			0	71	21	82
8/23/28	VIII B (3-4)	A + Calcium chloride	2.70 2.00	10	6.5	55	50	Warm. Cloudy.			0			0	55	19	81
8/23/28	VIII B (4-5)	A + Calcium chloride	2.70 2.00	2	5	55	50	Warm. Cloudy.			0			0	59	21	66
8/24/28	VIII B (5-6)	A + Ammonium chloride	2.70 0.16	12	7	56	60	Rain in early a.m. Cool. Cloudy.			0			0	72	32	78
8/25/28	VIII B (6-6.6)	A + Ammonium chloride	2.70 0.16	7	6.5	55	60	Cool, cloudy in a.m. Rain in p.m.			0			0	78	52	61
8/27/28	IX A (0-.4)	A + Ammonium chloride	2.70 0.16	2	5	54	79	Cool. Frequent showers.			0			0	71	32	40
8/27/28	IX A (.4-1)	A + Ammonium chloride	2.70 0.42	12	5.5	54	79	Cool. Frequent showers.			0			0	70	30	48
8/27/28	IX A (1-2)	A + Ammonium chloride	2.70 0.42	7	6	54	76	Cool. Cloudy. Rain in p.m.			0	85	25	4	65	29	74
8/28/28	IX A (2-3)	A + Ammonium chloride	2.70 0.42	2	5	52	65	Heavy fog in a.m. Warm. Cloudy in p.m.			0			0	78	36	80
8/29/28	IX A (3-4)	A + Ammonium chloride	2.70 0.89	2	5	50	47	Warm. Clear.			0			0	88	57	68
8/29/28	IX B (0-.4)	A + Ammonium chloride	2.70 0.89	7	5	50	47	Warm. Clear.			0	100	100	1	79	43	67
8/29/28	IX B (.4-1)	A + Ammonium chloride	2.70 0.89	12	8	50	47	Warm. Clear.			0	100	100	1	75	32	110
8/30/28	IX B (1-2)	A + Calcium chloride	2.70 1.20	10	6.5	50	46	Warm. Clear.			0	78	25	4	55	13	69
8/30/28	IX B (2-3)	A + Calcium chloride	2.70 1.20	2	5	50	46	Warm. Clear.			0			0	62	24	72
8/31/28	V B (0-.95)	A + Perchloric acid	2.70 0.08		4.5	52	48	Warm. Clear.			0	96	50	2	65	20	65
8/31/28	V B (1-2)	A + Sulphuric acid	2.70 0.08		8	52	48	Warm. Clear.			0	79	0	1	78	41	101
9/1/28	Ex. 19	A	1.40	2	5	52	48	Warm. Clear.	100	100	17			0			0

(1) Symbol for sodium chlorate.
(2) Concentration of chemical expressed in this report as pounds per gallon instead of per cent by weight as in 1928 report.

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Discussion of Idaho Work. The four best spray formulae for the destruction of G. inermis gave the following percentage kill of bushes: sodium chlorate plus manganese chloride 97%, sodium chlorate alone pH 6.8, 72%, sodium chlorate plus potassium permanganate 64%, sodium chlorate plus sodium hydroxide 59%. The results of the sodium chlorate manganese chloride mixture are probably not an exact statement of the toxicity owing to the fact that the Ribes on this particular station were small bushes, and due to the complete nature of the kill it was difficult to distinguish G. inermis from R. lacustre. This formula, however, will bear further investigation. Slight adjustments of pH from 5-8 appear to make very little difference to the toxicity of the spray. Strongly alkaline sprays or strongly acid sprays showed considerable difference, however, the alkaline sprays as previously reported being much more effective than the acid sprays. Taking into consideration the size and vigor of the Ribes to which the above sprays were applied and the general vigor of the partially killed bushes the alkaline chlorate spray stands out as the best Ribicide for G. inermis.

The same four sprays named above showed most promising results on R. lacustre, and are sufficiently toxic that they might well be recommended for field use were it not for the fire risk attached to the application of sprays containing 2.7 pounds chlorate per gallon of water. The four most effective Ribicides for R. lacustre averaged 94% kill of bushes.

One of the upsets of the 1929 season was the observed susceptibility of R. viscosissimum to chlorates. A 15% solution (1 lb. per gal. water) killed 97% of the bushes. As previously noted for R. petiolare and G. inermis, the addition of calcium chloride rendered the chlorate somewhat less toxic. Best results were obtained at pH of 6.8. The addition of ammonium chloride did not reduce the toxicity of the sodium chlorate to any great extent.

Results of rather small tests on R. petiolare of dilute solutions of chlorate with and without an additional oxidizing agent showed that solutions at pH 6.8 were quite effective. Reduction of the acidity to pH of 2, however, is not advisable. Chlorate at pH 12 showed several resprouts from the crown and some live stem not completely killed.

Chemical eradication plots located on the South Fork of the Stanislaus River, and at Leland Meadow in the Stanislaus National Forest were checked during the first two weeks of June by d'Urbal and Van Atta. A summary of the spray effectiveness is given in Table 2.

Discussion of Idaho Work. The four best spray formulae for the destruction of C. inermis gave the following percentage kill of bushes: sodium chlorate plus manganese chloride 97%, sodium chlorate alone pH 8.8, 72%, sodium chlorate plus potassium permanganate 69%, sodium chlorate plus sodium hydroxide 65%. The results of the sodium chlorate manganese chloride mixture are probably not an exact statement of the toxicity owing to the fact that the sites on this particular station were small bushes, and due to the complete nature of the kill it was difficult to distinguish C. inermis from R. lacustre. This formula, however, will bear further investigation. Slight adjustments of pH from 5-8 appear to make very little difference in the toxicity of the spray. Strongly alkaline sprays or strongly acid sprays showed considerable difference, however, the alkaline sprays as previously reported being much more effective than the acid sprays. Taking into consideration the size and vigor of the bushes to which the above sprays were applied and the general vigor of the particular field bushes the alkaline chlorate spray stands out as the best chlorate for C. inermis.

The same four sprays named above showed most promising results on R. lacustre, and are sufficiently toxic that they might well be recommended for field use were it not for the fire risk attached to the application of sprays containing 2.7 pounds chlorate per gallon of water. The four most effective herbicides for R. lacustre averaged 94% kill of bushes.

One of the upsets of the 1939 season was the decreased susceptibility of R. viscosissimum to chlorates. A 15% solution (1 lb. per gal. water) killed 97% of the bushes. As previously noted for R. petiolare and C. inermis, the addition of calcium chloride rendered the chlorate somewhat less toxic. Best results were obtained at pH of 5.6. The addition of ammonium chloride did not reduce the toxicity of the sodium chlorate to any great extent.

Results of rather small tests on R. petiolare of dilute solutions of chlorate with and without an additional oxidizing agent showed that solutions at pH 6.0 were quite effective. Reduction of the acidity to pH of 2, however, is not advisable. Chlorate at pH 12 showed several resprouts from the crown and some live stem not completely killed.

Chemical eradication plots located on the South Fork of the Stanislaus River, and at Leland Meadow in the Stanislaus National Forest were checked during the first two weeks of June by Offord and Van Atta. A summary of the spray effectiveness is given in Table 2.

TABLE NO. 2

RESULTS OF 1928 EXPERIMENTAL SPRAYING IN CALIFORNIA
DATA TAKEN IN 1929

Date of Application	Plot Number	Chemical Used	Concentration Lbs. Per Gal. H_2O	pH of Spray	Gallons Spray Used	At Time of Application: Average Soil Temperature 7 a.m. to 5 p.m. Deg. F.	At Time of Application: Average Relative Humidity 7 a.m. to 5 p.m.	At Time of Application: Weather Log	R. nevadense: Live Stem Killed Per Cent	R. nevadense: Bushes Killed Per Cent	R. nevadense: Bushes Treated Number	G. roezli: Live Stem Killed Per Cent	G. roezli: Bushes Killed Per Cent	G. roezli: Bushes Treated Number
6/20/28	S.F. Stanislaus I A (0-1) Area I	A (1) + Calcium chloride	2.70 2.80	9	10.5	52	55	Warm. Clear.	98	43	87			0
6/21/28	I A (1-2)	A + Calcium chloride	2.70 3.00	9	8	51	56	Warm. Clear.	96	36	95			0
6/21/28	I B (0-1)	A + Calcium chloride	2.70 2.40	9	7	51	56	Warm. Clear.	98	75	68	91	63	8
6/21/28	I B (1-2)	A + Ammonium chloride	2.70 1.50	5.6	6	51	56	Warm. Clear.	96	61	78			0
6/23/28	I B (2-3)	A + Ammonium chloride	2.70 1.60	5.6	7	54	52	Warm. Clear.	98	88	91	21	0	2
6/23/28	I A (2-3)	A + Ammonium chloride	2.70 1.80	5.6	3	54	52	Warm. Clear.	99	69	29	33	0	1
6/25/28	II A (0-1)	A + Sodium dichromate	1.40 0.42		10	54	56	Warm. Clear.	92	32	66			0
6/25/28	II B (0-1)	A	3.40		1.5	54	56	Warm. Clear.	99	91	11			0
6/25/28	II A (2-3)	A + Sodium tetraborate	1.40 0.42		6.5	54	56	Warm. Clear.	98	81	27			0
6/26/28	II B (1-2)	A	1.40	9	4	52	56	Warm. Clear.	99	89	28			0
6/26/28	II B (2-3)	A + Potassium permanganate	1.40 0.42		3	52	56	Warm. Clear.	97	50	28			0
6/26/28	II A (1-1.5)	Ammonium chloride + Sodium dichromate	0.89 0.42		5.5	52	56	Warm. Clear.	17	0	23	35	0	1
6/26/28	II A (1.5-1.7)	Ammonium chloride	1.40	5.5	4	52	56	Warm. Clear.	52	12	17			0
6/26/28	II A (1.7-2)	Ammonium chloride	2.70	5.6	5	52	56	Warm. Clear.	71	0	32			0
6/27/28	I A (0-1) Area III	Ammonium chloride	1.40	5.9	11	51	59	Cloudy at intervals			0	85	5	40
6/27/28	I A (1-1.5)	Ammonium chloride	2.70	5.8	4	51	59	Cloudy at intervals			0	81	3	31
6/27/28	I A (1.5-2)	Ammonium chloride + Sodium dichromate	0.89 0.42		3	51	59	Cloudy at intervals			0	36	0	11
6/27/28	I B (0-1)	Sodium hypochlorite (2)	$\frac{1}{4}$ Strength		4	51	59	Cloudy at intervals	4	0	1	39	0	10
6/27/28	II A (2-3)	Sodium hypochlorite	$\frac{1}{2}$ Strength		2	51	59	Cloudy at intervals	11	0	1	42	0	5
6/27/28	II B (2-3)	Sodium hypochlorite	Full Strength		4	51	59	Cloudy at intervals			0	32	0	14
6/28/28	I A (2-3)	Ammonium persulphate + Ammonium chloride	0.89 0.42		3	52	65	Cloudy at intervals			0	36	0	17
6/28/28	I B (1-1.5)	A + Ammonium chloride	2.70 1.60		3	52	65	Cloudy at intervals			0	90	43	21
6/28/28	I B (1.5-2)	A + Ammonium chloride	2.70 1.40		5	52	65	Cloudy at intervals			0	95	50	20
6/29/28	I B (2-3)	A + Calcium chloride	2.70 2.80	9	5	52	56	Warm. Clear.			0	55	31	19
6/29/28	II A (1-2)	A + Calcium chloride	2.70 2.40	9	4	52	56	Warm. Clear.			0	99	86	21
6/29/28	II A (0-1)	A + Calcium chloride	2.70 3.00	9	5	52	56	Warm. Clear.			0	99	89	9
6/29/28	II B (0-1)	A + Ammonium chloride	2.70 1.80	5.6	1	52	56	Warm. Clear.			0	95	50	8
6/29/28	II B (1-2)	Potassium permanganate + Acetic acid	0.42 0.08		4	52	56	Warm. Clear.			0	35	3	33
6/30/28	II A Area II (0-1)	Sodium hypochlorite	Full Strength		1	53	61	Cloudy.	52	0	7	36	0	8
6/30/28	II B (0-1)	Sodium hypochlorite	$\frac{1}{2}$ Strength		2	53	61	Cloudy.				32	0	16
6/30/28	II B (3-4)	Sodium dichromate	0.89		2	53	61	Cloudy.	18	0	14	11	0	3
7/2/28	II B (6-6.6)	Potassium permanganate + Acetic acid	0.89 0.08		1	52	62	Cloudy at intervals	10	0	1			0
7/2/28	II B (4-5)	Ammonium persulphate + Acetic acid	0.89 0.16		3	52	62	Cloudy at intervals	2	0	11	33	0	7
7/3/28	II A (1-2)	A + Calcium chloride	2.70 2.40	4.4	6	53	50	Warm. Clear.	99	83	35	45	25	4
7/3/28	II A (2-3)	A + Calcium chloride	2.70 2.80	4.4	8	53	50	Warm. Clear.	99	70	43	87	40	5
7/5/28	II A (3-4)	A + Ammonium chloride	2.70 1.60	9	3.5	53	59	Warm. Clear.	99	80	51	27	0	2
7/5/28	II A (4-5)	A + Ammonium chloride	2.70 1.80	9	6	53	59	Warm. Clear.	94	48	56	84	33	12
7/5/28	II A (6-6.6)	A + Ammonium chloride	2.70 1.50	9	1	53	59	Warm. Clear.	96	25	4			0

(1) Symbol for sodium chlorate.
(2) A commercial product. Percentage NaOCl standard.

(Continued on next page.)

TABLE NO. 2 (Continued)

RESULTS OF 1928 EXPERIMENTAL SPRAYING IN CALIFORNIA
DATA TAKEN IN 1929

Date of Applica-tion	Plot Number	Chemical Used	Concen-tration Lbs. Per Gal. H_2O	pH of Spray	Gal-lons Spray Used	At Time of Application: Average Soil Temper-ature 7 a.m. to 5 p.m. Deg. F.	At Time of Application: Average Rela-tive Humidi-ty 7 a.m. to 5 p.m.	At Time of Application: Weather Log	R. nevedense: Live Stem Killed Per Cent	R. nevedense: Bushes Killed Per Cent	R. nevedense: Bushes Treated Number	G. roezli: Live Stem Killed Per Cent	G. roezli: Bushes Killed Per Cent	G. roezli: Bushes Treated Number
7/6/28	I A (0-1)	A (1) + Ammonium chloride	2.70 1.60	4.4	6	53	49	Warm. Clear.	99	57	7	85	11	9
7/6/28	I A (1-2)	A + Ammonium chloride	2.70 1.80	4.4	7	53	49	Warm. Clear.	100	100	5	97	40	20
7/6/28	III B (1-2)	Sodium tetraborate	0.16	9	9	53	49	Warm. Clear.	0	0	1	0	0	7
7/6/28	II B (1-2)	Sodium tetraborate + Ammonium chloride	0.16 0.89	9	3	53	49	Warm. Clear.	27	0	18	50	0	2
7/8/28	II B (2-3)	Sodium hypochlorite (2)	½ Strength		8				7	0	27	16	0	9
7/9/28	II B (5-5.6)	Sodium tetraborate + Potassium permanganate	0.16 0.16		3				0	0	10			0
7/9/28	II B (5.6-6)	Sodium dichromate + Sodium hydroxide	0.89 0.16		1				25	0	4			0
7/9/28	III A (0-1)	Sodium dichromate + Sulphuric acid	0.89 0.16		2.5						0	15	0	18
7/9/28	III B (0-1)	Sodium dichromate + Sodium hydroxide	0.89 0.16		2				1	0	3	6	0	16
7/11/28	III A (1-2)	Sodium tetraborate + Sulphuric acid	0.16 0.16		1	52	50	Warm. Clear.			0	28	0	7
7/11/28	I A (2-3)	A + Ammonium chloride	2.70 1.20	4.4	3	52	50	Warm. Clear.	99	75	4	84	28	14
7/11/28	I B (0-1)	A + Ammonium chloride	2.70 1.60	9	1	52	50	Warm. Clear.	100	100	2	71	40	5
7/11/28	I B (1-2)	A + Ammonium chloride	2.70 2.00	9	3	52	50	Warm. Clear.	98	33	3	94	35	14
7/11/28	I B (2-3)	A + Ammonium chloride	2.70 1.20	9	3	52	50	Warm. Clear.	99	85	14	90	11	19
7/26/28	Leland Meadow III A (0-1)	A	3.40	12	5	60	57	Warm. Clear.			0	88	59	39
7/26/28	III A (1-2)	A	2.00	12	2	60	57	Warm. Clear.			0	96	49	41
7/26/28	III A (2-3)	A	1.40	12	4	60	57	Warm. Clear.			0	92	26	15
7/27/28	III A (3-4)	A	3.40	2	4	61	59	Warm. Clear.			0	96	35	17
7/27/28	III A (4-5)	A	2.00	2	3	61	59	Warm. Clear.			0	75	26	23
7/27/28	III A (5-6)	A	1.40	2	2	61	59	Warm. Clear.			0	86		2
7/27/28	III A (6-6.6)	Ammonium chloride + Acetic acid	2.70 0.16	2		61	59	Warm. Clear.			0	83	0	8
7/28/28	Leland Meadow IX A (0-1)	A + Calcium chloride	2.70 3.00	12	6	61	60	Warm. Clear.			0	89	65	17
7/28/28	IX A (1-2)	A + Calcium chloride	2.70 2.40	12	3.5	61	60	Warm. Clear.			0	98	38	13
7/28/28	IX B (0-1)	A + Calcium chloride	2.70 2.80	12	3	61	60	Warm. Clear.			0	54	18	17
7/28/28	IX B (1-2)	A + Furfural	2.70 0.16	7	3.5	61	60	Warm. Clear.			0	62	41	34
7/29/28	Leland Meadow I A (0-1)	A + Furfural	1.40 0.08	7	5	60	57	Warm. Clear.	99	95	20			0
7/29/28	I A (1-2)	A + Furfural	1.40 0.16	7	9	60	57	Warm. Clear.	99	93	44			0
7/29/28	I A (2-3)	A + Furfural	2.70 0.08	7	3	60	57	Warm. Clear.	99	89	9			0
7/29/28	Leland Meadow IV B (0-1)	A + Furfural	2.70 0.16	7	6	60	57	Warm. Clear.	99	97	31			0
7/29/28	IV B (1-1.5)	A + Sodium hydroxide	2.70 0.16		11	60	57	Warm. Clear.	99	90	39			0
7/30/28	IV B (1.5-2)	A + Sodium hydroxide	2.70 0.08		6			Warm. Clear.	99	88	16			0
7/30/28	IV A (0-.7)	Furfural	0.42		6			Warm. Clear.	29		26			0
7/30/28	IV A (.7-1)	A + Ammonium chloride + Furfural	2.00 1.40 0.16		7			Warm. Clear.	100	100	30			0
7/30/28	V B (0-1)	A + Ammonium chloride + Furfural	1.00 1.20 0.04		4			Warm. Clear.	82	42	19			0
									Manzanite			Ceanothus		
8/2/28	Manzanita and Ceanothus bushes. Western edge of meadow marked with stake.	A	2.70	6.8	4			Warm. Clear.	100	100	2	100	100	5

(1) Symbol for sodium chlorate.
(2) A commercial product. Percentage NaOCl standard.

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Discussion of California Work. Results of the application of chemicals to G. roezli do not promise a satisfactory Ribicide. G. roezli is very resistant to a large range of formulae tested by spray application, closely approximating the resistance exhibited by G. inermis in Idaho. Sodium chlorate alone, or sodium chlorate mixed with ammonium chloride or calcium chloride in acid, basic or neutral solutions gave mediocre results. 85 to 90% kill was obtained with sodium chlorate and calcium chloride on Area III, on the South Fork of Stanislaus. The bushes affected were in an open moist piece of land. On the same area G. roezli sprayed with a mixture of sodium chlorate with an intermediate concentration of calcium chloride gave only 31% kill. The latter experiment was performed on G. roezli growing in a drier location. Complete and partial kills are shown by photographs W. 840 and W. 843.

R. nevadense is much more susceptible to all chemicals than G. roezli, as reference to Table 2 shows. However, in view of d'Urbal's observation that R. nevadense frequently resprouts the second year after application the percentage of kill should not be taken as final. An excellent kill was obtained in Leland Meadow in the moist and shady southeast end of the meadow with a mixture of sodium chlorate, furfural and ammonium chloride, and, also with a mixture of sodium chlorate and furfural. These results may, in part, be attributed to the favorable conditions in the southeast corner of the meadow. A high percentage of kill (89-91) was obtained with straight sodium chlorate in another area. Furfural chlorate mixtures, however, are to be investigated further. Typical killing action on R. nevadense is illustrated by photographs W. 838 and W. 839.

In general, the action of sodium chlorate alone, on both G. roezli and R. nevadense, is more effective than mixtures of sodium chlorate with calcium chloride or with ammonium chloride in acid and alkali solutions.

Conditions of low humidity which exist for the greater part of the summer in the Sierra regions undoubtedly militate against the successful chemical eradication of Ribes. Unless a chemical can be developed which penetrates in lethal quantities before the spray dries under the existing low humidity, it may be necessary to resort to late season applications of a spray, or root applications of a hygroscopic mixture.

Chemical plots established at Still Creek and at Veda Lake, Oregon, in 1928, were rechecked in July of 1929 by d'Urbal after a preliminary examination by the writer. Data were recorded for live stem and bushes killed in the usual way and the percentage kill of live stem and bushes reported in Table 3 are given for R. bracteosum and R. lacustre.

Discussion of California tests. Results of the applications of chemicals to A. roezli [illegible] a [illegible] [illegible] [illegible]. A. roezli is very resistant to a large range of foliage [illegible] spray application, closely approximating the resistance exhibited by G. inermis in Idaho. Sodium chlorate alone, or sodium chlorate mixed with ammonium chloride or calcium chloride in acid, basic or neutral solutions gave mediocre results. [illegible] to [illegible] kill was obtained with sodium chlorate and calcium chloride on [illegible] [illegible] [illegible] fork of Stanislaus. The bushes affected were in an [illegible] of land. In the same area A. roezli sprayed with a mixture of sodium chlorate with an intermediate concentration of calcium chloride were only [illegible] kill. The latter experiment was continued on A. roezli growing in a drier location. Complete [illegible] kill [illegible] [illegible] photographs [illegible] 840 [illegible] [illegible].

A. nevadense is much more resistant [illegible] all [illegible] than A. roezli, as reference to table [illegible] shows. However, in [illegible] [illegible] observation that A. nevadense frequently [illegible] [illegible] year after application the percentage of kill should not be taken as final. An excellent kill was obtained in [illegible] [illegible] [illegible] continent end of the [illegible] with mixtures of sodium chlorate, furfural and ammonium chloride, and, also with a mixture of sodium chlorate and furfural. These results may, in part, be attributed to [illegible] favorable conditions in the [illegible] [illegible] [illegible]. [illegible] percentage of kill ([illegible]) was obtained with [illegible] sodium chlorate in another area. Furfural chlorate mixtures, however, are to be investigated further. [illegible] [illegible], A. nevadense is illustrated by photographs [illegible] [illegible] [illegible].

In general, the action of sodium chlorate alone, on both A. roezli and A. nevadense, is more effective than mixtures of sodium chlorate with calcium chloride or with ammonium chloride in [illegible] [illegible] solutions.

Conditions of low humidity, which exist for [illegible] [illegible] of the summer in the Sierra regions undoubtedly militate against [illegible] successful chemical eradication of ribes. Unless a chemical can be developed which penetrates in lethal quantities [illegible] [illegible] ribes under the existing low humidity, it may be necessary to resort to late season applications of [illegible] spray, or root applications of a [illegible] mixture.

Chemical plots established at [illegible] [illegible] [illegible] [illegible] region, in 1936, were rechecked in July of 1938 [illegible] after a preliminary examination by the [illegible]. Data were recorded [illegible] [illegible] and bushes killed in the [illegible] [illegible] and the percentage kill of live stem and bushes reported in Table [illegible] are given for L. [illegible] and [illegible].

TABLE NO. 3

RESULTS OF 1928 EXPERIMENTAL SPRAYING IN OREGON
DATA TAKEN IN 1929

Date of Application	Plot Number	Chemical Used	Concentration Lbs. per Gal. H_2O	pH of Spray	Gallons Spray Used	Weather Log At Time of Application (1)	R. bracteosum Live Stem Killed Per Cent	R. bracteosum Bushes Killed Per Cent	R. bracteosum Bushes Treated Number	R. lacustre Live Stem Killed Per Cent	R. lacustre Bushes Killed Per Cent	R. lacustre Bushes Treated Number
7/25/28	Still Creek I A (0-1)	A (2) + Calcium chloride	2.70 2.80	9.0	12.0	Fog in early a.m. Weather generally fair for remainder of day.	94	33	33	99	30	27
7/26/28	I A (1-2)	A	1.40	6.8	3.0	do	99	63	8	96	20	10
7/26/28	I A (2-3)	A + Sodium hydroxide	1.40 0.16		1.0	do	90	29	14	99	0	2
7/26/28	I B (0-1)	A + Calcium chloride	2.70 3.00	9.0	2.0	do	99	20	10			0
7/26/28	I B (1-2)	A + Sodium hydroxide	2.00 0.16		1.0	do			0	94	0	5
7/26/28	I B (2-3)	A + Sodium hydroxide	0.89 0.16		1.0	do	40	0	1	95	14	7
7/26/28	II A (0-1)	A	2.00	6.8	3.5	do	97	48	23	99	50	2
7/26/28	II A (1-2)	A + Calcium chloride	2.70 2.40	9.0	6.0	do	99	39	28	94	43	7
7/27/28	Veda Lake I A (0-1)	A + Calcium chloride	2.70 2.80	9.0	6.0	do			0	99	75	44
7/27/28	I A (1-2)	A + Sodium hydroxide	0.89 0.16		11.0	do	95	0	11	98	49	68
7/28/28	I B (0-1)	A + Sodium hydroxide	0.89 0.42		1.0	do			0	100	100	3
7/28/28	I B (1-2)	A	0.89	6.8	10.0	Fog in early a. m. Remainder of day clear and cool.	95	0	13	95	15	33
7/28/28	I B (2-3)	A	2.00	6.8	19.0	do	99	16	23	99	69	29
7/30/28	I B (3-4)	A + Sodium hydroxide	2.70 0.16		17.0	do	98	20	10	98	46	45
7/30/28	I A (2-3)	A + Sodium hydroxide	1.40 0.16		12.0	do	98	30	47	98	58	40
7/31/28	I A (3-4)	A + Sodium hydroxide	2.00 0.16		11.0	do	97	23	40	98	67	30

(1) Relative humidity and soil temperature not taken during 1928 Oregon spraying.
(2) Sodium chlorate.

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W.840-G. roezli in Plot I Area II, S.F. Stanislaus River, Calif. Completely killed. Sprayed July, 1928 with $NaClO_3$ 2.7 lbs. + ammonium chloride 1.6 lbs. per gal. water, pH 9. Picture taken July, 1928.

W.843-G. roezli in Plot IX A (0-1) Leland Meadow, Calif. Resprouting from crown. Sprayed July 1928 with $NaClO_3$ 2.7 lbs. + $CaCl_2$ 3.0 lbs. per gal. water, pH 12. Picture taken July, 1929.

W.839-R. nevadense in Plot 1 Area I, S.F. of Stanislaus River, Calif. Resprouting from crown. Sprayed June, 1928 with $NaClO_3$ 2.7 lbs. + $CaCl_2$ 2.4 lbs. per gal. of water, pH 9. Picture taken July, 1929.

W.838-R. nevadense in Plot 1 Area I, S.F. of Stanislaus River. Completely killed. Sprayed June, 1928 with $NaClO_3$ 2.7 lbs. + $CaCl_2$ 2.4 lbs. per gal. water, pH 9. Picture taken July, 1929.

Discussion of Oregon Work. Chlorate sprays of concentration less than 1.4 per gallon (15%) were relatively ineffective on R. bracteosum. Chlorate sprays of higher concentration (2-2.7 lbs. per gal.) gave kills of 17 and 48%, respectively. The addition of alkali cut down the efficiency of the chlorate, viz.,

Spray	Alone	With 2% NaOH
Sodium chlorate .89 lb.	0% kill	0% kill
" " 1.4 lb.	63% kill	30% kill
" " 2.0 lbs.	17% kill	23% kill
" " 2.7 lbs.	48% kill	20% kill

The results of spraying R. lacustre were rather encouraging in view of the large mats of extremely vigorous bushes. This type of growth is extremely difficult to eradicate by hand. The kill of live stem was complete in almost all cases and the effectiveness of eradication is much greater than the percentage kill of bushes would indicate. R. lacustre as it grows in Oregon seems to be more susceptible to the toxic action of sodium chlorate than the same species under Idaho conditions. It is interesting to note from Table 3 that alkali increased the effectiveness of dilute solutions of chlorate on R. lacustre under Oregon conditions as it did in Idaho.

For both R. lacustre and R. bracteosum the effectiveness of a mixture of sodium chlorate and calcium chloride was inversely proportional to the calcium chloride content. At variance with this observation was a 75% kill of bushes obtained at Veda Lake with an intermediate concentration of calcium chloride added to the regular strength sodium chlorate.

The Application of New Ribicides in Idaho, California and Oregon in 1929.

At Santa, Idaho, new Ribicides were tested by spray application to the sun forms of G. inermis and R. lacustre. These plots were of regulation size, 100x33 feet. Plots were also located in the stream type in order to test the sprays on shade types of G. inermis and R. lacustre. These plots were marked with stakes in the regular manner but were not of uniform size owing to the scattered distribution of Ribes. Stream type plots are indicated in Table 4 by Ex. followed by a number, and were located opposite permanent plots X and XI. A summary of the experiments performed is given in Table 4.

Discussion of Oregon Work. Chlorate sprays of concentration less than 1.4 per gallon (lbs) were relatively ineffective on L. bracteosum. Chlorate sprays of higher concentration (2.0-2.7 lbs. per gal.) gave kills of 17 and 45%, respectively. The addition of alkali cut down the efficiency of the chlorate, viz.,

Spray			Alone	With [illegible]
Sodium chlorate	.83 lb.		0% kill	[illegible] kill
"	1.4 lb.	"	5% kill	[illegible] kill
"	2.0 lbs.	"	17% kill	[illegible] kill
"	2.7 lbs.	"	45% kill	[illegible] kill

The results of spraying H. lacustre were rather encouraging in view of the large mats of extremely vigorous [illegible]. This type of growth is extremely difficult to [illegible]. The kill of [illegible] stem was complete in almost all cases and the effectiveness of [illegible] action is much greater than the percentage kill of [illegible]. H. lacustre as it grows in Oregon seems to be more [illegible] to the toxic action of sodium chlorate than the same species under Idaho conditions. It is interesting to note from Table [illegible] that alkali increased the effectiveness of dilute solutions of chlorate on H. lacustre under Oregon conditions as it did in Idaho.

For both H. lacustre and L. bracteosum the effectiveness of [illegible] mixture of sodium chlorate and calcium chloride was inversely [illegible] to the calcium chloride content. [illegible] variance with this observation [illegible] a 75% kill of bushes obtained [illegible] with an intermediate concentration of calcium chloride added to the regular strength sodium chlorate.

The Application of New [illegible] in Idaho, California and Oregon in [illegible].

At [illegible], Idaho, new [illegible] were tested by spray application to the same forms of G. inermis and H. lacustre. These plots were of regulation size, 100x33 feet. Plots were also located in the stream type in order to test the sprays on shade types of G. inermis and H. lacustre. These plots were marked with stakes in the regular manner but were not of uniform size owing to the scattered distribution of bushes. Stream type plots are indicated in Table 4 as Nr. followed by a number, and were located opposite permanent plots [illegible] and [illegible]. A summary of the experiments performed is given in Table 4.

TABLE NO. 4

SUMMARY OF EXPERIMENTAL SPRAYS APPLIED AT SANTA, IDAHO, DURING 1929 FIELD SEASON

Date of Appli-cation	Plot Number	Chemical Used	Concen-tration Lbs. Per Gal. H_2O	pH of Spray	Gal-lons Spray Used	At Time of Application: Average Soil Temp. 7:30 a.m. to 5 p.m. Degrees F.	Average Relative Humidity 7:30 a.m. to 5 p.m.	Weather Log
7/2/29	XI A (0-1)	A (1) + Magnesium chloride	2.70 1.50	6.5	2.0	55	37	Warm. Clear.
7/8/29	XI A (1-1.6)	A + Magnesium chloride	2.70 1.50	8.0	2.0	56	59	Warm. Clear.
7/8/29	XI A (1.6-2)	A + Magnesium chloride	2.70 1.50	4.0	2.0	56	59	Warm. Clear.
7/8/29	XI A (2-2.5)	A + Magnesium chloride	2.70 0.75	8.0	3.5	56	59	Warm. Clear.
7/9/29	XI B (1-2.2)	Y (2)	3.54	6.5	5.0	57	48	Warm. Clear.
7/9/29	XI B (2.2-3)	Y (3)	3.54	6.5	5.0	57	48	Warm. Clear.
7/10/29	XI A (2.5-3)	A + Magnesium chloride	2.70 0.75	4.0	6.0	60	44	Warm. Clear.
7/10/29	XI A (3-3.6)	A + Magnesium chloride	2.70 0.75	6.5	3.0	60	44	Warm. Clear.
7/11/29	XI A (3.6-4)	A + Magnesium chloride	2.70 0.38	8.0	3.0	57	48	Warm. Cloudy.
7/11/29	XI B (3-3.5)	A + Magnesium chloride	2.70 0.38	6.5	2.0	57	48	
7/11/29	XI B (3.5-4)	A + Magnesium chloride	2.70 0.38	4.0	4.0	57	48	Warm. Cloudy.
7/12/29	XI B (0-1)	A + Magnesium chloride	2.70 0.19	8.0	2.0	55	43	Warm. Cloudy.
7/12/29	XI A (4-4.5)	A + Magnesium chloride	2.70 0.19	4.0	3.0	55	43	Warm. Cloudy.
7/12/29	XI A (4.5-5)	A + Magnesium chloride	2.70 0.19	6.5	4.0	55	43	Warm. Cloudy.
7/13/29	XI A (5-5.5)	Y (2) + Magnesium chloride	2.88	6.5	5.0	59	38	Warm. Clear.
7/15/29	XI B (4-4.4) XI A (5.5-6)	Y (2) + Glue + Glycerine	3.54	6.5	5.0			
7/17/29	XI B (4.4-5)	X (4) + Molasses	1.40	6.5	5.0	66	30	Hot. Clear.
7/17/29	XI B (5-6)	X + Molasses	2.00	6.5	5.0	66	30	Hot. Clear.
7/18/29	X B (0-.4)	X + Molasses	2.70	6.5	5.0	65	39	Hot. Clear.
7/18/29	X B (.4-1)	X + Molasses	3.40	6.5	5.0	65	39	Hot. Clear.
7/22/29	X B (1-1.5)	X + Glue	2.70	6.5	5.0	59	34	Warm. Clear.
7/22/29	Ex. 1	X + Molasses	2.70	6.5	5.0	65	27	Warm. Clear.
7/23/29	Ex. 2	X + Glycerine	2.70	6.5	5.0	56	24	Warm. Clear.
7/23/29	XII A (0-.05)	X + Molasses	2.70	6.5	5.0	60	35	Warm. Clear.
7/25/29	XII A (.05-.1)	X + Molasses	2.70	6.5	5.0			Warm. Clear.
7/26/29	XII A (.1-.2)	X + Sodium thiosulphate	0.42 4.12		5.0			Warm. Clear.
7/26/29	XII A (.2-.3)	X + Sodium thiosulphate	0.89 4.12		5.0			Warm. Clear.
8/8/29	X B (1.5-2)	X + Sodium thiosulphate	2.00 2.06		5.0	59	56	Warm. Clear
8/8/29	Ex. 3	Sodium thiosulphate	4.12		4.0	59	30	Warm. Clear.
8/9/29	Ex. 4	Sodium thiosulphate	3.09		5.0	58	26	Warm. Clear.
8/9/29	Ex. 5	Sodium thiosulphate	2.06		4.0	58	26	Warm. Clear.
8/24/29	Ex. 6	X + Glue (5) + Glycerine	0.89	8.0	6.0			
8/24/29	Ex. 7	X + Glue + Glycerine	1.40	8.0	5.0			
8/24/29	Ex. 8	X + Glue + Glycerine	2.00	8.0	5.0			
8/24/29	Ex. 9	X + Glue + Glycerine	2.70	8.0	5.0			
9/3/29	Ex. 10	Magnesium chlorate	3.40		14.0			
9/3/29	Ex. 11	X + Ammonium chloride	1.40 0.50		5.0			
9/3/29	Ex. 12	X + Ammonium chloride	1.40 0.80		5.0			
9/3/29	Ex. 13	X + Magnesium chloride	2.70 0.37	10.0	5.0			
9/3/29	Ex. 14	X + Magnesium chloride	2.70 0.19	10.0	5.0			

(1) Sodium chlorate.
(2) New complex series made in field (Cu 1 : S_2O_3 6 : CN 4).
(3) New complex series made in field (Cu 1 : S_2O_3 5 : CN 4).
(4) Standard complex furnished from quantity made in Spokane by H. R. Offord.
(5) Glue .02# per gallon water and glycerine .1 to .5# per gallon as sticker and binder.

Most of the experimental work in the Stanislaus National Forest was done at Gooseberry Camp near Strawberry in the southeast quarter of section 13, township 4 north, range 18 east. This area contained G. roezli in great numbers growing in semi-moist conditions in an area of aspen adjacent to a spring. Nearby, on an open hillside, spray applications were made on R. cereum. Area I, as noted in Table No. 5, comprised the R. cereum plots and Areas II and III contained the concentrations of G. roezli. Since this area did not contain suitable R. nevadense, applications of the X sprays to R. nevadense were made at Leland Meadow in the south end of the meadow adjacent to 1928 plots.

New Ribicides were applied to G. inermis in the Plumas National Forest in section 22 about one-fourth mile below the 1929 main eradication camp on Meadow Valley Creek. This area is about five feet above the water level of the creek and provides ideal growing conditions for G. inermis. The habitat of G. inermis, as it grows in these areas in California, resembles very closely areas of swamp willow and alder in which G. inermis and R. lacustre grow so profusely in Idaho. (See illustrations W. 846 and W. 847.) Owing to the extremely low humidities which persisted over the Meadow Valley area chlorates were not applied. Table No. 5 gives a summary of experimental spraying performed at Gooseberry Camp, Leland Meadow and Meadow Valley.

Most of the experimental work in the Stanislaus National Forest was done at Gooseberry Camp near Strawberry in the southeast quarter of section 16, township 4 north, range 19 east. This area contained R. roezli in great numbers growing in a wet-moist condition in an area of aspen adjacent to a spring. [illegible] spray applications were made on R. cereum. Area I, as noted in Table No. 5, comprised two R. cereum plots and Areas II and III contained the concentrations of R. roezli. Since this area did not have any suitable R. nevadense, applications of the sprays to R. nevadense were made at Leland Meadow in the south end of the meadow adjacent to 1938 plots.

Few ribicides were applied to R. inerme in the Eldorado National Forest in section 22 about one-fourth mile below the 1930 main eradication camp on Meadow Valley Creek. This area is about five feet above the water level of the creek and provides ideal growing conditions for R. inerme. The habitat of R. inerme, as it grows in these areas in California, resembles very closely areas of aspen, willow and alder in which R. inerme and R. lacustre grow in abundance in Idaho. (See illustrations p. 845 and p. 847.) Owing to the extremely low humidities which existed over the Meadow Valley area ribicides were not applied. Table No. 5 gives a summary of the treatments spraying performed at Gooseberry Camp, Leland Meadow and Meadow Valley.

TABLE NO. 5

SUMMARY OF EXPERIMENTAL SPRAYS APPLIED IN CALIFORNIA DURING 1929 FIELD SEASON

Date of Appli-cation	Plot Number	Chemical Used	Concen-tration Lbs. per Gal. H_2O	pH of Spray	Spray Used	At Time of Application Average Soil Temp. 7 a. m. to 5 p.m. Deg. F.	Average Relative Humidity	Weather Log
6/20/29	Gooseberry Camp S (3)	Y (1)	4.96	10.0	5	25	23	Warm. Clear.
6/22/29	I Aa Area I	Y (1)	3.54	6.5	5	56	21	Warm. Clear.
6/22/29	I Ab Area I	Y (1)	2.16	6.5	5	56	21	Warm. Clear.
6/22/29	I Ac Area I	Y (1)	1.41	6.5	5	56	21	Warm. Clear.
6/24/29	I Aa Area II	Y (2)	2.88	6.5	5	56	22	Warm. Clear.
6/24/29	I Ab Area II	Y (3)	3.54	6.5	5	56	22	Warm. Clear.
6/24/29	I Ac Area II	Y (3)	2.88	6.5	5	56	22	Warm. Clear.
6/24/29	I Ba Area II	Y (3)	2.88	6.5	5	56	22	Warm. Clear.
6/25/29	I Bb Area II	Y (2)	3.54	6.5	5	51	25	Warm. Clear.
6/25/29	2a Area II	X (4) + Molasses	2.40	6.5	5	51	25	Warm. Clear.
6/25/29	2b Area II	X + Glycerine (5)	2.70 0.04	6.5	5	51	25	Warm. Clear.
6/26/29	2c Area II	X + Glycerine	2.70 0.24	6.5	5	56	33	Warm. Clear.
6/26/29	2d Area II	X + Molasses (6) + Magnesium chloride	2.70 0.38	6.5	5	56	33	Warm. Clear.
6/26/29	2e Area II	X + Glue (7)	2.70	6.5	5	56	33	Warm. Clear.
6/26/29	2f Area II	X + Molasses + Sodium thiosulphate	2.40 2.09	6.5	5	56	33	Warm. Clear.
6/27/29	3a Area II	A (8) + Magnesium chloride	2.70 2.60	6.5	5	57	34	Warm. Clear.
6/27/29	3b Area II	A + Magnesium chloride	2.70 2.60	12.0	5	57	34	Warm. Clear.
7/3/29	Leland Meadow V A (1-1a)	X + Glycerine	3.57 0.08	6.5	5		40	Clear. Warm.
7/3/29	V A (1a-1b	X + Glycerine	2.70 0.24	6.5	5		40	Clear. Warm.
7/3/29	IV A (0-.7)	X + Glycerine	2.40 0.20	6.5	5		40	Clear. Warm.
7/10/29	Meadow Valley I	X + Molasses	2.70 0.96	6.5	30		47	Clear and warm with cold morning and high humidity in early a.m.
7/12/29	II (A) 0	X + Glue + Glycerine	2.70 0.16	6.5	10		40	Clear and warm with cold morning and high humidity in early a.m.
7/12/29	II (A) 1	X + Glue + Magnesium chloride	2.70 0.50	6.5	10		40	Clear and warm with cold morning and high humidity in early a.m.
7/15/29	III A (0-a)	Y (3) + Glycerine	2.16 0.20	6.5	10		46	Clear and warm with cold morning and high humidity in early a.m.
7/15/29	III B (0-a)	Y (3) + Glue + Glycerine	2.88 0.20	6.5	10		46	Clear and warm with cold morning and high humidity in early a.m.
7/15/29	IV A (0-a)	Y (3) + Glycerine	3.54 0.20	6.5	10		46	Clear and warm with cold morning and high humidity in early a.m.
7/15/29	IV A (a-b)	Y (3) + Glycerine	3.54 0.96	6.5	10		46	Clear and warm with cold morning and high humidity in early a.m.

(1) Complex series made in field (Cu 1 : S_2O_3 8 : CN 2).
(2) Complex series made in field (Cu 1 : S_2O_3 7 : CN 3).
(3) Complex series made in field (Cu 1 : S_2O_3 7 : CN 4).
(4) Standard complex from lot made in Spokane by H. R. Offord.
(5) Glycerine added as binder 0.1# per gallon water.
(6) Molasses added as a binder 0.2# per gallon water.
(7) Glue added as a sticker 0.02# per gallon water.
(8) Symbol for sodium chlorate.

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W.846-Showing the intimate association of G. inermis and willow, Meadow Valley Creek, Meadow Valley, Calif. Hand eradication of G. inermis under these conditions is very costly.

W.847-Showing typical growth of G. inermis in stream type, Meadow Valley Creek, Meadow Valley, Calif.

The 1929 spraying in Oregon tested chemicals on R.bracteosum, G.watsoniana, R.sanguineum and R.triste. R.bracteosum plots were located one and a half miles down stream from the Still Creek camp on the west bank of the stream. Sprays were applied to G.watsoniana in an area south of the Loop Highway about 3 miles east of White River and a short distance east of the North Fork of Iron Creek. The site is an open southeast exposure covered with bracken fern and surrounded on three sides by Douglas fir. The bushes are in scattered clumps and were fruiting heavily at the time when chemicals were applied.
The 1929 R.sanguineum plots were located at Hoover, Oregon, five miles up the Santiam River above Detroit in the Santiam National Forest. About two miles above Hoover (old abandoned logging camp) the area is marked by a sign on the right hand side of the road. The area is moderately brushy and cut over, very hot and dry, and the Ribes medium in size growing in scattered clumps. R.triste plots were established on the west bank of Mud Creek one-fourth mile from the mouth of the creek. The steep talus slope adjacent to the stream ends in shelf rock and on this shelf rock in the shade of alder, willow and red osier, R.triste grew in great abundance. Table No. 6 summarizes the experiments performed at Still Creek, Loop Highway, Santiam River and Mud Creek. Table 6a summarizes the respraying experiments conducted in the Veda Lake and Still Creek areas over 1928 plots.

TABLE NO. 6

SUMMARY OF EXPERIMENTAL SPRAYS APPLIED IN OREGON DURING 1929 FIELD SEASON

Date of Application	Plot Number	Chemical Used	Concentration Lbs. per Gal. H_2O	pH of Spray	Gallons Used	At Time of Application (1): Average Relative Humidity 7 a.m. to 5 p.m.	At Time of Application (1): Weather Log[2]
7/29/29	Still Creek I A (0-1)	X [3] + Glycerine	1.80	6.5	10	33	Clear. Warm.
7/30/29	I A (1-2)	X + Glycerine + Glue	2.40	6.5	10	45	Sultry. Cloudy.
7/30/29	I A (2-3)	X + Glycerine	2.70	6.5	10	45	
7/30/29	I A (3-4)	X + Magnesium chloride	2.70 0.75	6.5	10	45	
7/31/29	I B (2-3)	A [4] + Glue + Magnesium chloride	1.40 1.50	6.5	10	54	Sultry. Cloudy.
8/1/29	I B (3-4)	Y [5] + Glycerine + Glue	2.16	6.5	10	80	Foggy.
8/2/29	II A (0-1)	Y + Glycerine + Glue	2.88	6.5	10	75	Foggy in early a.m. Clear in p.m.
8/2/29	II A (1-2)	Y + Glycerine + Glue	3.54	6.5	10	75	
8/6/29	Loop Highway I A	X + Glycerine	2.40	6.5	5	42	Hot. Clear.
8/6/29	II	X + Glycerine	2.70	6.5	5	42	Hot. Clear.
8/7/29	I B	Y + Glycerine	2.88	6.5	5	47	Hot. Clear.
8/7/29	III	Y + Glycerine	3.54	6.5	5	47	Hot. Clear.
8/8/29	IV A	A	1.40	6.8	5	37	Hot. Clear.
8/8/29	IV B	A + Glycerine + Sodium hydroxide	1.40 0.08		5	37	Hot. Clear.
8/13/29	Santiam River I	Y + Glycerine	2.88	6.5	5	23	Hot. Clear.
8/13/29	II	Y + Glycerine	3.54	6.5	5	23	Hot. Clear.
8/13/29	V	X + Glycerine	2.40	6.5	5	23	Hot. Clear.
8/13/29	VI	Y + Glycerine	3.54		5	23	Hot. Clear.
8/13/29	III	A + Glycerine	1.40	6.5	5	23	Hot. Clear.
8/13/29	IV	A + Glycerine + Sodium hydroxide	1.40 0.08		5	23	Hot. Clear.
8/17/29	Mud Creek I	Y	2.88		5	34	Clear. Warm.
8/17/29	II	X	2.40	6.5	5	34	Clear. Warm.
8/17/29	III	Y + Glycerine + Glue	3.54	6.5	5	34	Clear. Warm.
8/17/29	IV	X + Glycerine + Glue	2.70	6.5	5	34	Clear. Warm.
8/17/29	V	A + Glycerine + Glue	1.40	6.5	5	34	Clear. Warm.
8/17/29	VI	A + Sodium hydroxide	1.40 0.08		5	34	Clear. Warm.

(1) Soil temperatures were not taken.
(2) Weather characterized by high early morning humidity throughout course of Oregon work.
(3) Standard complex furnished from quantity made at Spokane by H. R. Offord.
(4) Sodium chlorate.
(5) New complex series made in field (Cu 1 : S_2O_3 6 : CN 4).

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TABLE NO. 6a

RESPRAY WORK IN OREGON, 1929 (1)

Date	Location	Chemical	Concentration	pH	Gals.	Weather Log
7/31/29	Area II I A (0-2)	$NaClO_3$ + NaOH	1.4# 0.08#		5	43% - 2 p.m. sultry 65% - 6 p.m. overcast
7/31/29	Area II I A (2-3)	$NaClO_3$	1.4#	6.8	4	Fog a.m.; clearing by noon.
7/31/29	Area I A (2-3)	$NaClO_3$	1.4#	6.8	5 on 3 plots	do

(1) The alkaline sprays were applied on sections containing a large amount of R. lacustre. The neutral sprays were applied on sections which contained more R. bracteosum.

Notes on Spraying as Performed Under Tables 4, 5 and 6.

Hopes for the mixture sodium chlorate and magnesium chloride as a possible Ribicide for G. inermis were rudely shattered when spontaneous fires in California and Idaho made further tests inadvisable. Although the mixture is more hygroscopic than the Atlacide mixture it seems to be much more readily decomposed in the presence of organic material.

Late season observations of the toxic action of X sprays suggested that the mixture is less toxic under field conditions than it was in the greenhouse. Some releafing was noted in the California, Oregon and Idaho areas, particularly in the shady locations. In general, direct exposure to the sunlight increased toxicity of the sprays. Glycerine proved to be the best binder and hygroscopic agent although the addition of the necessary 2 to 3% makes the price of the spray somewhat prohibitive. Moreover, it is possible that the addition of so much inert material materially reduces the toxic action of the complex.

Y sprays appeared to be generally less effective than the X complex in all three states where experiments were conducted. The high cyanide content, furthermore, makes these sprays very disagreeable to handle and may possibly rule them out on the basis of toxicity to livestock.

A number of experiments (not listed in the above tables) were carried out near Watsonville, California on Mr. Goodale's ranch. Complex X with molasses as a binder, and mixtures of sodium chlorate with magnesium chloride and Atlacide were tested by spray application to a planting of cultivated currants on April 17. The area was checked July 24, and the results photographically recorded by Mr. MacLeod. Complex X killed 50% live stem of R. aureum but the resprouts and remaining live stem appeared quite vigorous. It was more effective on the red currant, R. rubrum, but here again results were not encouraging. On black currants, R. nigrum, very little toxic action was apparent. Mixtures of magnesium or calcium chloride with sodium chlorate were equally effective, both sprays giving complete kills of R. nigrum. About 90% kill of R. rubrum bushes and 25% of R. aureum bushes were obtained with the chlorate mixtures. It is evident from these experiments that the susceptibility of cultivated black currants is about the same as R. petiolare.

Spray Formulae Recommended for Idaho, California and Oregon Ribes.

The spray formulae recommended are given under two classifications. Series A contains chemical formulae that have given a sufficiently

Notes on Spraying as Performed Under Tables 4, 5 and 6.

Hopes for the mixture sodium chlorate and magnesium chloride as a possible ribicide for *R. inerme* were rudely shattered when spontaneous fires in California and Idaho made further tests inadvisable. Although the mixture is more hygroscopic than the calcium mixture it seems to be much more readily decomposed in the presence of organic material.

Late season observations of the toxic action of X sprays suggested that the mixture is less toxic under field conditions than it was in the greenhouse. Some releafing was noted in the California, Oregon and Idaho areas, particularly in the shady locations. In general, direct exposure to the sunlight increased toxicity of the sprays. Glycerine proved to be the best binder and hygroscopic agent although the addition of the necessary 2 to 3% makes the price of the spray somewhat prohibitive. Moreover, it is possible that the addition of so much inert material materially reduces the toxic action of the complex.

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A number of experiments (not listed in the above tables) were carried out near Watsonville, California on Mr. Woodside's ranch. Complex X with molasses as a binder, and mixtures of sodium chlorate with magnesium chloride and sulfuric acid were tested by spray application to a planting of cultivated currants on April 17. The area was checked July 24, and the results photographically recorded by Mr. [illegible]. Complex X killed 50% live stem of *R. aureum* but the resprouts and remaining live stem appeared quite vigorous. It was more effective on the red currant, *R. rubrum*, but here again results were not encouraging. On black currants, *R. nigrum*, very little toxic action was apparent. Mixtures of magnesium or calcium chloride with sodium chlorate were equally effective, both sprays giving complete kills of *R. nigrum*. About 50% kill of *R. rubrum* bushes and 25% of *R. aureum* bushes were obtained with the chlorate mixtures. It is evident from these experiments that the susceptibility of cultivated black currants is about the same as *R. petiolare*.

Spray Formulae Recommended for Idaho, California and Oregon Sites.

The spray formulae recommended are given under two classifications. Series A contains chemical formulae that have given a satisfactory

high percentage of kill and are economically practical for use in control work. Series B suggests the most toxic chemical for each of the Ribes tested though not recommended for large scale field use as yet owing to high cost, toxicity to operator, or extreme fire hazard. The chemicals given in Series B have not been tested conclusively on a large scale.

Series A

Chemical	Concentration	pH	For Eradication of
Sodium chlorate or	0.89# per gal. water	6.1-6.8	R. petiolare
Atlacide	1.4# " " "	"	"
Sodium chlorate or (1)	1.4# " " "	5.6-6	R. viscosissimum
Atlacide	2.2# " " "	"	"

Series B

Chemical	Concentration	pH	For Eradication of
Sodium chlorate plus	3.4# per gal. water	6.4-6.8	R. lacustre
Manganese chloride	0.008# " " "		(Idaho)
			G. inermis
Sodium chlorate plus	2.7# " " "	9	G. roezli
Calcium chloride	2.4# " " "		
Sodium chlorate plus	1.0# " " "	Slightly	R. nevadense
Ammonium chloride plus	1.2# " " "	Acid	
Furfural	0.04# " " "		
Sodium chlorate	1.4# " " "	6.8	R. bracteosum
Sodium chlorate plus	2.7# " " "	9	R. lacustre
Calcium chloride	2.8# " " "		(Oregon)

Notes: (1) Recommendation for the chemical is made with a reservation concerning fire risk. Area should be watched during hot bright weather.
Glue .01% of the dry weight of chemical used is added as a sticker and a spreader of all above sprays.

TENTATIVE OUTLINE OF RESEARCH WORK TO BE UNDERTAKEN AT BERKELEY - 1929-1930

Preparatory Field Work.

A study of the total starch reserves and of the depletion of those starch reserves following application of a chlorate spray showed

high percentage of kill and are economically practical for use in control work. Series B suggests the most toxic chemical for each of the Ribes tested though not recommended for large scale field use as yet owing to high cost, toxicity to operator, or extreme fire hazard. The chemicals given in Series B have not been tested conclusively on a large scale.

Series A

Chemical	Concentration	pH	For eradication of
Sodium chlorate or	0.89# per gal.water	5.1-6.9	R. petiolare
Atlacide	1.4# " " "	"	"
Sodium chlorate or (1)	1.4# " " "	5.5-6	R. viscosissimum
Atlacide	2.3# " " "	"	"

Series B

Sodium chlorate plus	1.4# per gal.water	5.4-5.9	R. lacustre (Idaho) R. inermis
Manganese chloride	0.008# " " "		
Sodium chlorate plus	0.7# " " "	"	R. roezli
Calcium chloride	2.4# " " "		
Sodium chlorate plus	1.0# " " "	11 (NH3)	R. nevadense
Ammonium chloride plus	1.2# " " "	Acid	
Furfural	0.04# " " "		
Sodium chlorate	1.4# " " "	6.9	R. bracteosum
Sodium chlorate plus	2.7# " " "	3	R. lacustre (Oregon)
Calcium chloride	2.5# " " "		

Notes: (1) Recommendation for this chemical is made with a reservation concerning fire risk. Area should be watered during hot bright weather.

Glue .01% of the dry weight of chemical used is added as a sticker and a spreader for all above sprays.

TENTATIVE OUTLINE OF RESEARCH WORK TO BE UNDERTAKEN AT BERKELEY - 1935-1936

Preparatory Field Work.

A study of the total starch reserves and of the depletion of those starch reserves following application of a chlorate spray should

that the four Ribes species (Idaho) stand in the following order - R.petiolare, R.viscosissimum, R.lacustre and G.inermis in decreasing order of starch depletion following application of sodium chlorate and corresponding increasing of starch level maintained in the normal plant. In order to establish this fact on a quantitative basis, samples of the leaves, current stem, 1-year stem, old stem, layering stems, large roots and small roots of the four above-named Ribes were collected at 14-day intervals from June 1 to September 1. The total starch content will be determined quantitatively this winter at the University of Idaho.

Leaves of the same species were gathered at the same time for tannin determinations.

Material for morphological work to be undertaken by Mrs. Irma E. Webber at the University of California was carefully collected and included R.petiolare, G.inermis, R.lacustre and R.viscosissimum from Idaho; R.bracteosum, R.lacustre, G.watsoniana and R.triste from Oregon and R.nevadense, G.roezli and R.cereum from California.

Laboratory Experiments.

(1) Analysis of Ribes samples collected as previously stated.
Purpose. To establish quantitatively the relationship existing between the total starch reserve and susceptibility to chlorates and to correlate those results with the large scale seasonal tests of chlorate applied at Clarkia, Idaho. Ditto for tannins.

(2) Study of the chemistry of complex compounds, organic and inorganic.
Purpose. To devise new Ribicides for the destruction of Ribes heretofore resistant.

(3) Application of compounds devised under (2) to greenhouse Ribes.
Purpose. To obtain preliminary data on the toxicity of those compounds to several Ribes species.

(4) Study of the action of dilute chlorate solutions on Nitella in pH medium of 5.67 and 6.1 and 5.2.
Purpose. To obtain information concerning the toxic action of chlorates in pH medium exactly equivalent to the cell sap as further confirmation of the theory that maximum toxicity is secured where penetrating chemical corresponds most closely to the plant constituents and involves a minimum of initial reactions.

(5) Study of the reaction of starch-chlorate under various conditions under the influence of ultra-violet light. In the event of decomposition taking place a study of the decomposition products of that reaction.

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(5) Study of the reaction of starch-chlorate under various conditions under the influence of ultra-violet light. In the event of decomposition taking place a study of the decomposition products of that reaction.

Purpose. To furnish data on the mechanism of toxic action of chlorates and to determine, if possible, the toxic action of decomposition products.

(6) Study of the effect of chlorate on the respiration of Ribes.

Purpose. To obtain confirmation of the physiological nature of the stimulus provided by the chlorate and correlation, if possible, with seasonal habits of Ribes.

(7) Study of the spontaneous combustion of mixtures of organic materials with sodium chlorate under different light intensities, and the effect of negative catalyzers of that reaction.

Purpose. To reduce the fire hazard in connection with the use of chlorates by the addition of some inert material which affects accumulation of light intensity.

(8) Continuation of morphological work as outlined in 1928 annual report with the ecological forms of Ribes collected August of 1929 in Idaho, Oregon and California.

Purpose. To arrive at an understanding of structural differences which may account for differences previously observed in susceptibility to toxic chemicals. Formation of starch and tannins to be kept in mind in the course of work.

EXPERIMENTS WITH SPRAYING METHODS AND EQUIPMENT
MORRO CREEK, CALIFORNIA - 1929

By
H. E. Swanson,
Agent

INTRODUCTION

At the close of the 1928 field season, practical methods of operation for chemical eradication had been developed with both knapsack and power equipment. For a final determination of the relative costs of eradication between knapsack and power work, it was necessary to conduct a further experiment on an extensive scale. During the months following the close of the 1928 field season, a careful search was made for equipment which would be better suited for the work. Also some special attachments and equipment were designed and made up by members of the office personnel. Before making final recommendations for the 1929 field work, it was necessary to give this equipment a thorough trial. There was also a lack of a sufficient number of qualified supervisors with experience in chemical eradication, to conduct the work during the coming season. Consequently, there was a three-fold need of a large experimental project in chemical eradication to be conducted during January and February in order to give sufficient time for the purchase of equipment and the construction of any special equipment before starting work in Idaho in the following June.

PURPOSE

The purpose of the experimental project conducted in California is defined by the needs which it was to meet.

1. To determine the final relative costs of chemical eradication by the knapsack and power units.

2. To give the new types of equipment a complete and thorough trial.

3. To provide a training in chemical eradication for future field supervisors in the work.

LOCATION AND TIME OF WORK

California offered the only possibility of a representative area for this experimental work during the winter months. Considerable scouting was done between Berkeley and Los Angeles to find the most suitable location. Some difficulty was encountered in finding an area on which the conditions were comparable to those in Idaho. One on Morro

EXPERIMENTS WITH ERADICATION METHODS AND EQUIPMENT
[illegible] CREEK, CALIFORNIA - [illegible]

By

[illegible] Swanson,
Agent

INTRODUCTION

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Creek, in the northern end of the Santa Barbara National Forest was finally selected. Although not entirely satisfactory, this area approximated northern conditions and was adequate for the purposes of the project.

Actual experimental work was begun on Morro Creek on January 11, 1929 and completed on February 15, 1929.

PERSONNEL

Thirteen men from the Spokane Office carried on all the work. These men were from the eradication and reconnaissance projects and were men who will probably, in coming seasons, supervise chemical eradication units.

METHODS EMPLOYED

Distinct from the methods of eradication were the methods employed to secure the data necessary. For the comparison of costs between knapsack and power spraying, approximately one mile of stream type consisting of thirty acres was selected. This was first sprayed with knapsack equipment and then sprayed with power equipment. To secure the costs in heavy and medium concentrations, different kinds of brush were designated to be sprayed.

All the men used the various types of equipment to be tried out. Their reaction to its use gave a sound judgment as to the human factor involved in the ease of handling and carrying. The new equipment was used throughout to test its durability and a record kept as to any defects.

As a training project, each man performed the work as sprayer and performed all the other duties involved in both knapsack and power work. They assembled their own equipment at the beginning of the work and made any repairs or adjustments which were necessary after the equipment was put in use.

RESULTS

A. Determination of the relative costs of eradication by power and knapsack spraying.

1. Results in heavy concentration 30% - 40%.

Method of Work	No. of Acres	Man Hours Spraying	Man Hours Assisting	Total Man Hours	Gals. of Chem.	Per Acre: Man Hours Spraying	Per Acre: Man Hours Assisting	Per Acre: Total Man Hours	Per Acre: Gals. Chem.
Power	30	252	75	327	2,600	8.4	2.5	10.9	87
Knapsack	30	299	64	363	2,339	10.0	2.1	12.1	78

Cost per acre: power - $22.19 Knapsack - $18.34

*Basis of costs: $1.40 per man hour - power
$1.00 per man hour - knapsack
$.08 per gallon chemical

2. Results in medium concentration 10% - 13%.

Method of Work	No. of Acres	Man Hours Spraying	Man Hours Assisting	Total Man Hours	Gals. of Chem.	Per Acre: Man Hours Spraying	Per Acre: Man Hours Assisting	Per Acre: Total Man Hours	Per Acre: Gals. Chem.
Power	23	113.0	34.0	147	939	5.0	1.4	6.4	41
Knapsack	23	79.7	13.3	93	692	3.4	0.6	4.0	30

Cost per acre: power - $12.21 Knapsack $6.45

3. Conclusions.

a. In heavy concentrations, the cost of power work proved to be 21% greater than knapsack.

b. In medium concentrations, the cost of power work proved to be 89% greater than knapsack.

*Based on costs resulting from power spraying at Musselshell Creek and knapsack spraying work on Clearwater and Potlatch Timber Protective Associations in 1929.

B. Description of Methods Employed.

1. Power method.

a. Organization.
One foreman
One main-line hoseman
One mechanic
Ten sprayers

b. Equipment.
Two motors (Ross pumper and Pacific Marine)
2,200 feet ½" main-line hose in 100-ft. sections
3,000 feet ¼" lateral hose line in 300-ft. sections
400 feet ¼" hose in 200-ft. sections
10 utility trigger nozzles with 4-ft. extensions and ball checks

c. Method of working.

The main-line hose, which is connected with the motor, is laid down the valley or canyon. Where a road or trail is present, it is well to use it for the laying of the main line. The width of the stream type determines the position of the main line. Where the width is 3 chains or under, the main line is laid in the open along the outer edge of the stream type. In case of wider stream type, the main line is laid within the stream type itself and approximately 3 chains from one of the side boundaries of the stream type. Three chains represents the distance which can be worked each way from the main line and for the best performance of the work, the main line is laid so as to have the 3-chain width on one side at least. The entire 2,200 feet of main line hose is laid out with Y couplings equipped with shut-offs at every 100 ft. section. As the power unit proceeds down the stream, it is the duty of the hose man to move the main-line hose from the upper end, when it becomes free, and couple it in and lay it out on the lower end. This provides a continuous line of ½" hose down the valley. A motor is inserted in this main line hose every 1,800 or 2,000 feet. A mechanic is in charge at the motor and he also mixes the chemical solution. At 125# average pressure, the pumper is capable of providing the main-line hose with solution at sufficient pressure for a distance of 1,500 feet. The ten sprayers or nozzlemen are provided with a 300-ft. section of ¼" lateral with utility trigger nozzle and ball check, and 4-ft. extension. Each nozzleman is assigned to a 100-ft. section of the stream type along the main line. In case of narrow stream type, he is given a 200-ft. section. He couples his lateral to the main line. The usual method of work is for him to spray his first strip across the stream type, at the end of which he detaches his nozzle, the ball check preventing the flow of spray, and proceeds to lay the string line for his next strip. When this string line is laid, the nozzleman is back again

on the main line hose at the intake end of his lateral. He now pulls in his lateral, attaches his nozzle and proceeds to spray the next strip. In this manner, each nozzleman works out his section, both spraying his strips and laying them out with string line. As each man finishes a block or section he uncouples his lateral and carries it down to the lower end of the main line where the hose man assigns him to a new section or block. Thus there is no move of the entire unit at one time, but it is simply a method having a main-line hose down the valley to which the men couple their laterals and work out a block of stream type, then move down to another section. Irregularities in the stream type often cause a deviation from the usual method of handling the lateral hose in working out a block. In most cases these irregularities constitute an advantage in the saving of time. Experienced nozzlemen can often save time by making use of these irregularities. In the case of tributary streams, these can be worked by laying out extra lengths of hose from 200 feet to 600 feet or as far up the draws as is necessary. The size of the stream would determine the number of men to be assigned to blocks, in order not to hold up the operations on the main drainage. It is necessary for the foreman of the unit to assist both the hose man and the mechanic. It is his duty to have the motor which is not in operation set up and ready to be connected with the main line.

2. Knapsack method.

a. Organization.
One foreman
Six sprayers

b. Equipment.

Six knapsacks and pack boards
Six Brown double-action pumps
Six No. 111 Fine nozzles with 2-ft. extensions
Five mixing boilers, five 1-gal. measures, five 3-gal. buckets

c. Method of working. The foreman lays out blocks for the sprayers. Each block consists of about a chain section of the stream type and is divided by string lines into $\frac{1}{4}$-chain strips. The size of the stream and brush conditions will determine whether such strips are to be run parallel with or crosswise of the stream. Each man is assigned to a block. Filling stations, with a boiler at each, are established at convenient places, preferably between every two blocks or on the average of about every two or three chains along the stream. The foreman moves the boilers, establishes the filling stations and mixes chemical for the men when the time permits. However, the men mix most of the chemical which they use.

There is some question as to the practicability of spending the added time in laying string line for individual strips in place of eliminating half of this time by widening the strips for a two-man crew.

on the main line hose at the intake end of his lateral. He now pulls in his lateral, attaches his nozzle and proceeds to spray the next strip. In this manner, each nozzleman works out his section, both spraying his strips and laying them out with string line. As each man finishes a block or section he uncouples his lateral and carries it down to the lower end of the main line where the hose man assigns him to a new section or block. Thus there is no move of the entire unit at one time, but it is simply a method having a main-line hose down the valley to which the men couple their laterals and work out a block of stream type, then move down to another section. Irregularities in the stream type often cause a deviation from the usual method of handling the lateral hose in working out a block. In most cases these irregularities constitute an advantage in the saving of time. Experienced nozzlemen can often save time by making use of these irregularities. In the case of tributary streams, these can be worked by laying out extra lengths of hose from 200 feet to 600 feet or as far up the draws as is necessary. The size of the stream would determine the number of men to be assigned to blocks, in order not to hold up the operations on the main drainage. It is necessary for the foreman of the unit to assist both the hose man and the mechanic. It is his duty to have the motor which is not in operation set up and ready to be connected with the main line.

2. Knapsack method.

a. Organization.

One foreman
Six sprayers

b. Equipment.

Six knapsacks and pack boards
Six Brown double-action pumps
Six No. 111 fine nozzles with 2-ft. extensions
Five mixing boilers, five ½-gal. measures, five 2-gal. buckets

c. Method of working. The foreman lays out blocks for the sprayers. Each block consists of about a chain section of the stream type and is divided by string lines into ½-chain strips. The size of the stream and brush conditions will determine whether such strips are to be run parallel with or crosswise of the stream. Each man is assigned to a block. Filling stations, with a boiler at each, are established at convenient places, preferably between every two blocks or on the average of about every two or three chains along the stream. The foreman moves the boilers, establishes the filling stations and mixes chemical for the men when the time permits. However, the men mix most of the chemical which they use.

There is some question as to the practicability of spending the added time in laying string line for individual strips in place of eliminating half of this time by widening the strips for a two-man crew,

Experience has demonstrated the following facts conclusively in regard to two-man (or more) crews equipped with knapsacks. A two-man crew presents two alternatives.

(1) Each man must wait until his partner empties his spray tank. Two men cannot, with satisfactory consistency, empty their tanks at the same time. The facts against this method are that the slowest man will be setting the speed; in addition to the time lost in waiting while spraying, will be the time lost in waiting for each other to fill their tanks; the rate of travel will be governed by the heaviest brush on the strip in place of a counter-balance between the light and heavy.

(2) Each man must return to the filling station and refill his tank without waiting for his partner. This practice results in a situation whereby one man a good part of his time is covering a two-man strip, which is impractical from the standpoint of speed and efficiency. This situation will continue over a large portion of the day, unless one man waits for the other. Confusion results when a man returns with a full tank without knowing where his partner left off spraying.

Both of these alternatives have the disadvantage of the loss in output of work resulting from men working together. They often spray each other or are in each other's way. Overspraying also occurs, since a "sprayed bush" does not appear as a "pulled bush". A man's attention cannot be directed entirely to his own work. On the other hand, individual responsibility and incentive to a greater output of work result from the individual block system. All duplication and lost motion are eliminated. By working along a man's output is increased by 14%. This was the situation with permanent personnel. With temporary men the difference would undoubtedly be greater. Under average conditions a man can lay string line for six men. With the increase in output accomplished by the individual strip system, time will be saved if conditions are such that the foreman can lay string for only three men along with his duties of establishing filling stations. In so far as possible, knapsack sprayers should work independently of each other.

In regard to laying string line, one man should always work along. Where two men are laying string line on the same strip, they are guiding each other and when one has difficulty in getting through the brush, the other one is held up regardless of how easy his own path may be.

C. Test on New Equipment.

1. Power.

a. Solution-cooled motors. Previous experience indicated that air-cooled motors were unsatisfactory for this work. The solution-cooled motors proved very satisfactory and no trouble was caused by overheating.

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b. Ball checks. The arrangement of a ball check on the nozzle end of the $\frac{1}{4}$" lateral hoses proved entirely satisfactory and made possible the working out of the individual block system in power work.

c. Four-foor-1/8" iron extensions. These extensions, being much lighter than the former heavy $\frac{1}{4}$" iron, were very easily handled and were sufficiently strong. The added length, although causing some difficulty in dense brush, offered a distinct advantage by giving the nozzleman a longer reach.

d. $\frac{1}{4}$" hose for main line. This hose proved to be too small to handle a large unit. It could only supply 5 nozzles with sufficient spray. Consequently it cannot be used for anything but laterals. There is a possibility of 3/8" hose being satisfactory for main line.

2. Knapsack.

a. Double-action pumps. The double-action pump proved a great advancement over the single-action pump which had been used. The ease with which 50# pressure and more was obtained made it possible to use the No. 111 Fine nozzle, which makes a 20% saving on spray over the standard golden spray nozzle formerly used on the single-action pumps.

Two makes of double-action pumps were given a trial, the Brown pump and the Hudson pump. There are some differences in construction. Both of the Hudson pumps which were used proved to be of too delicate construction for use in this work. During the first week of work, both of these pumps had been broken beyond repair. On the other hand, the Brown pump, although being very light in construction, which is a distinct advantage when carrying it through the brush, remained intact through some of the most severe tests. All the Brown pumps, six in number, used throughout the knapsack work, were all in good working order at the close of the project. As the Brown pump is now sold on the market, there is one minor change which must be made, and that is the braising or welding on, in place of soldering, of a small piece on the end of the pump.

b. 2-ft.-1/8" iron extensions. These extensions with $\frac{1}{4}$" bushing and $\frac{1}{4}$" reducer on either end make a very satisfactory extension for the hand pump. They are considerably lighter in weight than the $\frac{1}{4}$" pipe and balance very well with the light Brown pump. They are sufficiently strong for the work.

c. Pack boards. There were four types of pack boards which were given a trial by each man.

1. Trapper Nelson - wire mesh and canvas covering.
2. Channel iron frame - wire mesh and canvas covering.
3. Clack pack frame.
4. Fibre board.

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On the Trapper Nelson frame and on the Channel iron frame, a wire mesh covering was used in place of the canvas back. The wire mesh, although very comfortable when the user was wearing a coat, galled the back when not covered with a coat. After the bending and general strain to which they were subjected, the wire tended to break which exposed sharp and pointed ends. On the basis of these findings, the wire mesh covering was deemed impractical.

The Channel iron frame, with a canvas covering, and the Trapper Nelson pack board, short and narrow in construction, were the two types of packs to which all the men gave first or second preference, from the standpoint of comfort and ease of carrying.

Trapper Nelson	Channel iron
5 - first choice	4 - first choice
4 - second choice	6 - second choice

Since these two types of packs have a similar shape, they are probably identical from the standpoint of comfort and ease of carrying. No costs have been obtained on either of these packs. The Trapper Nelson is a standard product and represents a more compact unit. The Channel iron, which can probably be made up somewhat cheaper than the Trapper Nelson, is not a standard article. The durability of the two types is also an unsettled question.

The Clack pack frame, used by the Forest Service for carrying fire motors, proved to be too rigid and was not comparable with the other types of boards from the standpoint of comfort and ease of carrying a load.

The fibre boards absorbed moisture to such a great extent as to cause them to warp completely out of shape, beyond use or repair. However, one fibre board, cut somewhat in the shape of a U with a little out of the center, was highly recommended by three men, but on the other hand there were five men who could not use it at all. Since it is advisable to get one standard type of board which can be used by all men, with minor adjustments, all the fibre boards were eliminated.

d. Canvas knapsack tank. These proved unsatisfactory since they failed to hold water.

e. Double nozzle. A double spray nozzle was devised for spraying dense concentrations. The greater amount of spray with a larger spread was obtained with no greater effort. Although this double nozzle accomplished a saving in time, such saving did not compensate for the additional gallonage used. The test was made on a total area of 4 acres.

Note: With the double-action pump and the pack board, the disagreeable and fatiguing factors of knapsack work have been greatly reduced.

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D. Training Project

Twelve men obtained a thorough training in chemical eradication which should enable them to take over field projects during the coming season. This training included work in all the various tasks in both knapsack and power operations, which provided one with a comprehensive knowledge of all the details of both methods. The training also included instruction in the various types of equipment and their use and repair. The problems and difficulties in chemical eradication were brought to the attention of twelve men and with the combined and concentrated thought of this group of permanent personnel, various improvements were made in methods of operation. Also ideas were formulated as to the proper organization of a field unit for chemical eradication.

RECOMMENDATIONS FOR FUTURE WORK

A. Knapsack Spraying.

1. Knapsack spraying for all concentrations of Ribes.
2. Trapper Nelson pack frames for carrying tanks.
3. Double-action pump having specifications of Brown pump with necessary alterations.
4. 2-ft.-1/8" iron extensions.
5. No. 111 Fine nozzle.
6. Individual block system of working areas, except under special conditions where 2-man crew is required.
7. One foreman to supervise the work of four to six knapsack sprayers.

B. Power Spraying.

1. Further experiment with power equipment on areas with heavy Ribes concentrations.
2. Individual block system of spraying.
3. Power units consisting of one foreman, one hoseman, one mechanic and ten sprayers with equipment mentioned.
4. 4-ft.-1/8" iron extensions and ball check.

In the training of personnel and the testing of new equipment, the project on Morro Creek accomplished its purpose. In the comparison of knapsack and power, the experiment indicated that knapsack spraying had the advantage in all Ribes concentrations. Certain factors, which necessarily accompany experimental work of the nature conducted on Morro Creek, subtract from the practical value of the results. Consequently the data received are an indication of the true situation rather than a basis for final decision between the merits of power and knapsack spraying. Therefore, it is advisable to continue work on a practical basis. The cost data on a season's work could then be compared with the cost of work done by all the knapsack units in operation during the same

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season. This will give a comparison on the basis of practical work for a final determination between the merits of the two units.

Since the spread in cost of spraying larger areas having dense concentrations of Ribes was not great the recommendation to use power spraying further on an experimental basis is fully justified. It is felt that much improvement in methods of power spraying can still be made and that cost of conducting such work may be reduced accordingly. Whether reductions in costs resulting from further experiment with power spraying will be great enough to offset those resulting from further improvement in knapsack methods of spraying is the only question yet to be solved. If such a reduction in power spraying costs cannot be made then the only alternative is to discard power spraying equipment and methods in favor of knapsack spraying.

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EFFECTIVENESS OF CONTROL, 1929
By
H. N. Putnam
Associate Pathologist

The general purpose of this project is to determine the effectiveness of Ribes eradication in terms of pine protection. It is proposed to do this by means of the development of certain measuring sticks, or reference tables, to which the results of Ribes eradication can be referred and an intelligent estimate made in regard to the degree of protection afforded.

In conducting such studies several factors must be considered. The following list of individual reports represents what we have done in studying these factors:

Progress report on Cheekye plot studies, Cheekye, B. C.
Newman Lake Plot, Washington.
Infection survey at Rhododendron, Oregon.
Long Meadow Creek infection area.
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Progress report on studies of relative susceptibility of *Pinus monticola*, and *P. strobus* growing under western conditions.
General summary of work done in Project 4.2 and plans for future.

The general method employed in conducting permanent plot studies can be considered under three headings, which are self-explanatory. These are, (1) mapping and delimiting area of study, (2) plotting pines and Ribes, and (3) recording data on pines and Ribes. In the inspection of any plot already established only the third process is required.

The recording of data is done on the data sheets accompanying this report. Duplicates of all records are kept in the office. It may be noted that space is provided for five inspections for each tree, canker or Ribes.

There follow reports on the various studies already listed.

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WF-BRC #65-3/15/29.

INFECTION STUDIES - RIBES SHEET

Locality | Plot | Strip | Transect

Ribes No. and Species	In-spector	Date	Indiv. Bush or Clump	Area Covered (sq.ft.)	Height (feet)	Feet Live Stem	Total Number Leaves	Shade; Half Shade; Open	Infected Yes or No	Ribes Infection Data: % Leaves Infected	% Infection Per Leaf	% Inf.Sur.Bearing: Uredinia	Telia	Necrotic Areas	Remarks

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PLANT INDUSTRY

BLISTER-RUST CONTROL
429 LYON BUILDING,
SEATTLE, WASHINGTON,

WF-BRC-#66-11/27/29-Rev.

INFECTION STUDIES - PINE SHEET

Locality ______ Plot ______ Strip ______ Transect ______ Pine No. ______
Pine Sp. ______

Inspector	Date	White Pine Tree: Age	D.B.H. Inches	Height (feet)	Crown Class	Condition	Infected Yes or No	Cankers: Killing	Cankers: Non-killing	Crown: Height (feet)	Crown: Diam. (feet)	Feet Needle Stem	Years Needles Borne	Remarks

Canker Data

Unvariable Items	Date	Limb or Trunk Canker	Normal Circum. Canker Center	Face of Canker Measurements Inches: Circum. of Canker	Face of Canker Measurements Inches: Width	Face of Canker Measurements Inches: Length	Canker Stage	Growth Beyond Canker Dead	Distance Edge Limb Cank. to Trunk Ft.	Remarks
Canker No. ______										
Side Tree Infected ______										
Year Growth Infected ______										
Ht. Base Infected Limb ___ Ft.										
Ht. Center Trunk Cank. ___ Ft.										
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PROGRESS REPORT ON CHEEKYE PLOT STUDIES, CHEEKYE, B. C.

By
E. L. Joy
Junior Forester

INTRODUCTION

In the spring of 1923 a demonstration area was established at Cheekye, B. C. A circular plot with a 1,250-foot radius was surveyed and Ribes within this area were eradicated as completely as possible. Disease-free white-pine seedlings were than planted, three rows along each of 8 radii laid out at 45-degree intervals from north.

This area was burned over in the fall of 1925 necessitating the re-establishment of the plot in the spring of 1926. Again white-pine seedlings were planted along these 8 radii, this time one row along each radius instead of 3.

PURPOSE

This plot was established in order to determine the maximum distance white-pine blister rust will spread from native Ribes to western white pines under field conditions in the West. Two other studies which are being conducted at the same time are (1) the rate of killing of white-pine seedlings by blister rust and (2) a determination of the survival of planted pines.

WORK DONE AND RESULTS

The planted pines were examined in April and again in October, 1929. New stakes were set at one-chain intervals along each radius.

For the presentation of pine infection data secured in 1928, the planted pines were considered as being in three zones, namely, the zone outside the plot where Ribes were left, the protection zone or that strip 920 feet wide within the circumference, and the area protected which is a circular plot at the center having a 330-foot radius. This analysis showed that a 920-foot or even a 1,250-foot Ribes-free zone is not sufficient to protect pines from blister rust under conditions obtaining at Cheekye.

The same division into zones has been used for the purpose of analyzing the 1929 data. The difference between the average per cents of pines infected in each zone is not great as is shown in Table No. 1.

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TABLE NO. 1

RECORD OF INFECTION OF PLANTED PINES ON CHEEKYE PLOT, B.C., 1929

Radius	Outside Plot			Protection Zone (920 ft. in Width)			Area Protected (Inner Circle 330-ft. radius)			Total		
	Pines Exam	Pines Inf.	Per Cent Pines Inf.	Pines Exam.	Pines Inf.	Per Cent Pines Inf.	Pines Exam.	Pines Inf.	Per Cent Pines Inf.	Pines Exam.	Pines Inf.	Per Cent Pines Inf.
North	305	36	11.8	284	22	7.7	94	3	3.2	683	61	8.9
Northeast	187	18	9.6	256	16	6.3	94	5	5.3	537	39	7.3
East	85	5	5.9	264	29	11.0	96	9	9.4	445	43	9.7
Southeast	172	11	6.4	257	23	8.9	98	8	8.2	527	42	8.0
South	60	1	1.7	250	12	4.8	102	4	3.9	412	17	4.1
Southwest	118	10	8.5	259	13	5.0	93	6	6.5	470	29	6.2
West	64	5	7.8	220	32	14.5	100	12	12.0	384	49	12.8
Northwest	248	19	7.7	255	20	7.8	93	9	9.7	596	48	8.1
Totals & Averages	1,239	105	8.5	2,045	167	8.2	770	56	7.3	4,054	328	8.1

Comparing the 1929 results with those of 1928, a marked increase in the per cent of pines infected in the zone outside the plot, where Ribes were not eradicated, is seen. Because of this increase, the 1929 figures show expected results with the greatest amount of infection occurring outside the plot and the least around the center. A comparison of the 1928 and 1929 results is shown in Table No. 2.

TABLE NO. 2

COMPARISON OF THE 1928 AND 1929 INFECTION BY ZONES

Year Examined	Per Cent Pines Infected: Outside Plot	Protection Zone (920 Feet Width)	Area Protected (Inner Circle 330 ft. Radius)	Average
1928	5.5	6.4	5.1	5.9
1929	8.5	8.2	7.3	8.1
Per Cent Increase	3.0	1.8	2.2	2.2

As early as the fall of 1928 it was noted that a few of the planted pines had been killed by blister rust. Examination in 1929, 3½ years after planting, revealed the fact that this kill amounted to 12.8 per cent of the infected pines or 1 per cent of the total pines examined. A detailed account of this is given in the following table.

TABLE NO. 3

PLANTED PINES KILLED BY BLISTER RUST, CHEEKYE PLOT B. C. FALL, 1929

Radius	Number Infected	Number Killed by Blister Rust	Per Cent Killed by Blister Rust
North	61	9	14.8
Northeast	39	5	12.8
East	43	6	14.0
Southeast	42	4	9.5
South	17	2	11.8
Southwest	29	1	3.4
West	49	7	14.3
Northwest	48	8	16.7
Total	328	42	12.8

A record has been kept of the survival of the planted pines. Table No. 4 shows the analysis of this 3-year record.

Comparing the 1929 results with those of 1928, a marked increase in the per cent of pines infected in the zone outside the plot, where Ribes were not eradicated, is seen. Because of this increase, the 1929 figures show expected results with the greatest amount of infection occurring outside the plot and the least around the center. A comparison of the 1928 and 1929 results is shown in Table No. 2.

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1929	8.5	8.2	7.3	8.1
Per Cent Increase	3.0	1.8	2.2	2.2

As early as the fall of 1928 it was noted that a few of the planted pines had been killed by blister rust. Examination in 1929, 5½ years after planting, revealed the fact that this kill amounted to 12.8 per cent of the infected pines or 1 per cent of the total pines examined. A detailed account of this is given in the following table.

TABLE NO. 3

PLANTED PINES KILLED BY BLISTER RUST, CHEREYE PLOT S. C. FALL, 1929

Radius	Number Infected	Number Killed by Blister Rust	Per Cent Killed by Blister Rust
North	61	9	14.8
Northeast	39	5	12.8
East	43	6	14.0
Southeast	42	4	9.5
South	17	2	11.8
Southwest	29	1	3.4
West	49	7	14.3
Northwest	48	8	16.7
Total	328	42	12.8

A record has been kept of the survival of the planted pines. Table No. 4 shows the analysis of this 2-year record.

TABLE NO. 4

SURVIVAL OF PLANTED PINES, CHEEKYE PLOT.

Radius	Pines Planted Spring 1926	Per Cent Pines Surviving Fall 1927	Fall 1928	Fall 1929
North	771	92.3	89.6	88.8
Northeast	640	89.0	84.6	83.9
East	528	88.0	85.0	84.4
Southeast	660	81.9	81.5	79.8
South	515	81.7	80.6	80.0
Southwest**	660	69.8	70.0	71.2
West**	447	79.0	80.3	80.5
Northwest	714*	85.4	85.4	83.4
Total	4,965	83.7	82.3	81.7

*Corrected.
**Annual survival increase due to the finding of pines formerly hidden by dense mass of down logs and brush caused by fire.

CONCLUSIONS

The fact, as determined in 1928, that a 1,250-foot Ribes-free protection zone is not sufficient in regions comparable to the Cheekye area, is further strengthened by the 1929 results. The plot at Cheekye is not large enough to be used for the determination of the maximum distance the disease will spread from Ribes to pines in that region.

The study to determine the rate of killing of white-pine seedlings is very important and should be continued on this area. From the results obtained to date, it appears that a large per cent of the white-pine planting stock used for reforestation will be killed by blister rust within the first ten years if planted in a region where infection is already established. In like manner, nurseries will suffer very heavy losses if they are not adequately protected.

NEWMAN LAKE PLOT, WASHINGTON

By
R. E. Myers
Agent

PURPOSE

The purpose of this study is to determine the effect of Ribes lacustre as a factor in the intensification of white-pine blister rust after infection has become established on white pine.

LOCATION

The plot is located 26 miles northeast of Spokane, Washington, one-half mile west of Newman Lake in townships 26 and 27 north, range 5 east, sections 4, 5, 32, 33. It can be reached by automobile in one hour via Trent Road and Newman Lake - Foothills highway.

HISTORY

Blister-rust infection on pines was found on this area May 10, 1928 by R. L. MacLeod. Upon discovery of this infection intensive scouting was done but no other pine infection was found in this region.

WORK PERFORMED.

Scouting, eradication of R. inerme, necessary surveys and some basic data-taking were done by permanent personnel of the office preceding the field season of 1929. From July 5 to August 25, R. E. Myers and F. L. Joy continued the work on the plot.

The work on this area began with the discovery of the rust on white pines and subsequent scouting of the area during May 1928. This was followed by a topographic survey of the area by E. L. Joy and P. B. Rowe completed October 31, 1928.

The work of surveying the plot into chain-square transects was completed in May 1929. 46.8 acres were thus surveyed and mapped showing the location of all culture features and boundaries of types.

The first eradication of the R. inerme was done May 6-8, 1929, by members of the permanent personnel of the office. 121,404 feet of live stem were pulled in 24 man-days. Three weeks later the area was re-eradicated of 4,487 feet of R. inerme. A third eradication was done during the time basic data were taken on 25.4 acres and 993 additional feet of live stem of R. inerme were pulled. It was noted that all bushes pulled were of small size and with only a few small leaves.

NEWMAN LAKE PLOT, WASHINGTON

By
E. E. Myers
Agent

PURPOSE

The purpose of this study is to determine the effect of *Ribes lacustre* as a factor in the intensification of white-pine blister rust after infection has become established on white pine.

LOCATION

The plot is located 25 miles northeast of Spokane, Washington, one-half mile west of Newman Lake in townships 26 and 27 north, range 5 east, sections 4, 5, 32, 33. It can be reached by automobile in one hour via Trent Road and Newman Lake - Foothills highway.

HISTORY

Blister-rust infection on pines was found on this area May 10, 1928 by R. L. MacLeod. Upon discovery of this infection intensive scouting was done but no other pine infection was found in this region.

WORK PERFORMED.

Scouting, eradication of *R. inerme*, necessary surveys and some basic data-taking were done by permanent personnel of the office preceding the field season of 1929. From July 5 to August [illegible] J. E. Myers and L. L. Joy continued the work on the plot.

The work on this area began with the discovery of the rust on white pines and subsequent scouting of the area during May 1928. This was followed by a topographic survey of the area by R. L. Joy and F. E. Rowe completed October 31, 1928.

The work of surveying the plot into chain-square transects was completed in May 1929. 45.2 acres were thus surveyed and mapped showing the location of all culture features and boundaries of types.

The first eradication of the *R. inerme* was done May 6-8, 1929, by members of the permanent personnel of the office. 121,404 feet of live stem were pulled in 24 man-days. Three weeks later the area was re-eradicated of 4,457 feet of *R. inerme*. A third eradication was done during the time basic data were taken on 25.4 acres and 995 additional feet of live stem of *R. inerme* were pulled. It was noted that all bushes pulled were of small size and with only a few small leaves.

Basic data on R. lacustre and pines were taken during July and August on 25.4 acres. R. lacustre plants were re-examined for infection after August 15.

RESULTS

The following table shows the Ribes conditions on that portion of the 25.4 acres of the plot studied.

TABLE NO. 1

RIBES FEET OF LIVE STEM PER ACRE ON 25.4 ACRES STUDIED

Species	Feet of Live Stem Per Acre	Status
R. inerme	3,115	Eradicated 1929
R. lacustre	2,118	Left for Study
Total	5,273	

In Table No. 2 is shown the details of infection on R. lacustre.

TABLE NO. 2

DETAILS OF R. LACUSTRE INFECTION, NEWMAN LAKE PLOT, 1929

Type of Information	R. lacustre
Total Bushes Examined	559.00
Per Cent Bushes Infected	1.07
Per Cent Leaves Per Infected Bush	0.25
Per Cent Infected Surface Per Infected Leaf	2.32
Per Cent Infected Surface Bearing Telia	55.10
Parts Per Million Total Leaf Surface Bearing Telia*	.34

*The meaning of this ratio is that for one million square units of leaf surface there would be .34 square units of infected surface bearing telia.

It is evident from an examination of Table No. 2 that the R. lacustre at Newman Lake was very lightly infected. A high percentage of infected surface bore telia, but only a very small percentage of the total leaf surface was infected. This may be due chiefly to the small number of fruiting cankers on the area.

The following table is a compilation of data on the pines inspected on the plot classified according to D.B.H. classes and crown classes.

Basic data on R. lacustre and pines were taken during July and August on 25.4 acres. R. lacustre plants were re-examined for infection after August 15.

RESULTS

The following table shows the Ribes conditions on that portion of the 25.4 acres of the plot studied.

TABLE NO. 1

RIBES FEET OF LIVE STEM PER ACRE ON 25.4 ACRES STUDIED

Species	Feet of Live Stem Per Acre	Status
R. inerme	[illegible]	Eradicated 1929
R. lacustre	[illegible]	Left for Study
Total	[illegible]	

In table No. 2 is shown the details of infection of R. lacustre.

TABLE NO. 2

DETAILS OF R. LACUSTRE INFECTION, NEWMAN LAKE PLOT, 1929

Type of Information	R. lacustre
Total Bushes Examined	355.00
Per Cent Bushes Infected	[illegible]
Per Cent Leaves Per Infected Bush	0.26
Per Cent Infected Surface Per Infected Leaf	[illegible]
Per Cent Infected Surface Bearing Telia	[illegible]
Parts Per Million Total Leaf Surface Bearing Telia*	.34

*The meaning of this ratio is that for one million square units of leaf surface there would be .34 square units of infected surface bearing telia.

It is evident from an examination of Table No. 2 that the R. lacustre at Newman Lake was very lightly infected. A high percentage of infected surface bore telia, but only a very small percentage of the total leaf surface was infected. This may be due chiefly to the small number of fruiting cankers on the area.

The following table is a compilation of data on the pines infected on the plot classified according to T.S.N. classes and crown classes.

TABLE NO. 3

TOTAL NUMBER OF TREES INSPECTED AT NEWMAN LAKE 1929 CLASSIFIED ACCORDING TO INFECTION, CROWN CLASSES, AND DBH CLASSES

D.B.H. Classes Inches	Trees Not Infected Crown Classes				Infected Trees Crown Classes				Total Trees Crown Classes			
	Dom.	Int.	Sup.	Total	Dom.	Int.	Sup.	Total	Dom.	Int.	Sup.	Total
0- .5	46	87	288	421	2	6	4	12	48	93	292	433
.6-1.5	15	36	86	137	9	4	3	16	24	40	89	153
1.6-2.5	12	22	39	73	13	7	2	22	25	29	41	95
2.6-3.5	9	12	9	30	1	1	0	2	10	13	9	32
3.6-4.5	8	1	0	9	6	1	0	7	14	2	0	16
4.6-5.5	6	4	0	10	2	0	0	2	8	4	0	12
5.6-6.5	2	1	0	3	4	0	0	4	6	1	0	7
6.6-7.5	1	0	0	1	3	0	0	3	4	0	0	4
Totals	99	163	422	684	40	19	9	68	139	182	431	752

Table No. 3 has been further analyzed in Table No. 4 to show the per cent of pines infected by crown and D. B. H. classes.

TABLE NO. 4

PERCENTAGE OF PINES INFECTED AT NEWMAN LAKE, 1929 BY CROWN CLASSES AND DBH CLASSES

D.B.H. Classes Inches	Per Cent of Trees Infected			
	Dominant	Intermediate	Suppressed	Total
0- .5	4.2	6.4	1.4	2.8
.6-1.5	37.5	10.0	3.4	10.5
1.6-2.5	52.0	24.1	4.9	23.2
2.6-3.5	10.0	7.7	0.0	6.2
3.6-4.5	42.9	50.0	-	43.7
4.6-5.5	25.0	0.0	-	16.7
5.6-6.5	66.7	0.0	-	57.1
6.6-7.5	75.0	-	-	75.0
Total	28.8	10.4	2.1	9.0

The above table indicates clearly that dominant trees are the most susceptible to blister rust and those of the intermediate and suppressed classes decidedly less susceptible. The dominant class is obviously composed of the thriftiest trees. It follows therefore, that blister rust will do the greatest damage to the most valuable trees in a stand.

TABLE NO. 3

TOTAL NUMBER OF TREES INSPECTED AT [illegible] LAKE 1929 CLASSIFIED ACCORDING TO INFECTION, CROWN CLASSES, AND DBH CLASSES

D.B.H. Classes	Trees Not Infected				Infected Trees				Total Trees			
	Crown Classes				Crown Classes				Crown Classes			
Inches	Dom.	Int.	Sup.	Total	Dom.	Int.	Sup.	Total	Dom.	Int.	Sup.	Total
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1.6-2.5	12	22	39	73	13	7	2	22	25	29	41	95
2.6-3.5	9	12	9	30	1	1	0	2	10	13	9	32
3.6-4.5	8	1	0	9	6	1	0	7	14	2	0	16
4.6-5.5	6	4	0	10	2	0	0	2	8	4	0	12
5.6-6.5	2	1	0	3	4	0	0	4	6	1	0	7
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The above table indicates clearly that dominant trees are the most susceptible to blister rust and those of the intermediate and suppressed classes decidedly less susceptible. The dominant class is obviously composed of the thriftiest trees. It follows therefore, that blister rust will do the greatest damage to the most valuable trees in a stand.

In Tables No. 5 and 6 there are shown analyses of all cankers found on this plot.

TABLE NO. 5

ANALYSIS OF CANKERS 1929

Year of Growth Infected	Number of Cankers							
	First Symptoms	Juvenile	Pycnia	Produced Aecia: Once	Twice	Several Times	Dead	Totals
1927	17	6	1					24
1926	187	93	3	1				284
1925	86	43	3			1		133
1924	32	24	5	1	1			63
1923	4	2	1		1	2	1	11
1922				1	1	6	2	10
1921					1	2	4	7
1920							1	1
1919								0
1918						1*		1
Totals	326	168	13	3	4	12	8	534**

*This canker may possibly have originated prior to 1923 but the evidence is not sufficient to be conclusive.

**Does not include 21 cankers found and removed May 1928. (See Table No. 6).

TABLE NO. 6

ANALYSIS OF CANKERS FOUND AND REMOVED MAY 1928

Year Growth Infected	Number of Cankers				
	Produced Aecia: Once	Twice	Several Times	Dead	Totals
1923	1	1			2
1922	1	14			15
1921		1			1
Unknown				3	3
Totals	2	16		3	21

It is evident from an examination of Tables No. 5 and 6 that infection probably originated during 1923 and that a large number of cankers

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1924	32	24	5	1	1			63
1923	4	2	1		1	2	1	11
1922				1	1	5	2	10
1921					1	2	4	7
1920							1	1
1919								0
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It is evident from an examination of Tables No. 5 and 6 that infection probably originated during 1923 and that a large number of cankers

was formed in 1927. There were 43 cankers originating in 1923 and 512 since 1923, most of these in 1927, which gives the ratio of 1 to 12.

WORK TO BE DONE

1. Continuation of the present studies over a period of years.
2. Extension of the plot to the upper slope limits of the white-pine type.
3. Development of measuring standards for feet of needle stem estimates and ratio of Ribes leaf surface to actual area occupied.
4. Securing relative humidity records on the plot.

CONCLUSION

At Newman Lake two waves of infection are apparent, one in 1923 and the other in 1927. These occurred in the ratio of 1 in 1923 to 12 in 1927. This rate of increase in number of cankers of one wave over that preceding was chargeable to 3,155 feet of live stem of R. inerme and 2,118 feet of live stem of R. lacustre per acre. The R. inerme was removed in the spring of 1929 before the time of Ribes infection, and in 1931 we can begin to observe the effect of the remaining R. lacustre upon the rate of increase of pine infection and thus obtain an index to the effect of R. lacustre as a factor in the intensification of white-pine blister rust after infection has established itself on white pine.

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INFECTION SURVEY AT RHODODENDRON, OREGON

By
H. N. Putnam
Associate Pathologist

PURPOSE

The purpose of the infection survey at Rhododendron was to obtain by means of a cruise of the area average infection conditions chargeable to average amount of different Ribes species.

LOCATION

The area studied lies in the Rhododendron region, Multnomah County, Oregon, southwest of Mt. Hood, along Zigzag River and its tributaries 5 miles east of Brightwood in township 2 south, range 7 east, sections 29, 30, 31, 32, 33, and township 3 south, range 7 east, sections 2, 3, 4, 11, 12, 13.

GENERAL SITUATION

In this region there are several good-sized streams flowing almost parallel in the same valley. Still Creek, Camp Creek, Henry Creek, and Zigzag River, occupy the same general valley at Rhododendron. White pines 31 to 40 years old occur growing mostly as suppressed individuals under an overstory of Douglas fir, cedar, and an occasional white pine. The pines are mostly limited to the valley floor.

HISTORY OF INFECTION AND WORK DONE

In September, 1928, infection both on pines and Ribes species was found in this region for the first time by Goodding and assistants. In April, 1929, Goodding and Putnam re-examined the area and found a large number of young cankers of 1927 origin developing. In October, 1929, an intensive study of the area was made by E. L. Joy, R. E. Myers, C. M. Chapman, F. F. Staat and H. N. Putnam in cooperation with L. N. Goodding and M. C. Riley. Strips 1/2-chain wide were run across the valley. There were 19 such strips put in, 20 chains apart making a 2½% cruise of the valley area. Data were taken on location of host plants and streams; on size and infection of Ribes species; and on age, height, crown class and number of cankers on pines.

There follow statistics derived from the data on all of the strips:

Length of valley covered..................................4¾ miles
Number of strips 20 chains apart..........................19
Width of strips... ½ chain
Average length of strips..................................37+ chains

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There follow statistics derived from the data on all of the strips:

Length of valley covered.................................4½ miles
Number of strips 20 chains apart.......................19
Width of strips...½ chain
Average length of strips..................................35+ chains

Acres in strips	35.17
Total pines inspected	698.0
Total pines infected	94.0
Per cent of pines infected	13.5
Waves of infection occurred in 1923 and 1927	
Total cankers of 1923 origin	125.0
" " originating since 1923	1378.0
Average number cankers per infected tree	16.0
Largest number of cankers on one tree	962.0
Number of pines per acre	19.8
Number of _R. bracteosum_ locations per acre	1.7
" " _R. lacustre_ " " "	5.6
" " _R. sanguineum_ " " "	.6
Total number of Ribes locations per acre	7.9
Feet live stem of _R. bracteosum_ per acre	419.0
" " " " _R. lacustre_ " "	527.0
" " " " _R. sanguineum_ " "	125.0
" " " " all Ribes " "	1071.0
Per cent of _R. bracteosum_ locations infected	26.2
" " " _R. lacustre_ " "	2.0
Average per cent leaves infected per infected bush of _R. bracteosum_	35.6
Average per cent leaves infected per infected bush of _R. lacustre_	10.8

No infection found on _R. sanguineum_.

The chief value of this study, the statistics on which are shown above, lies in the fact that it constitutes a quantitative and impartial statement of pine infection chargeable to a certain amount of Ribes live stem per acre. On this particular area the rust has been present since 1923. A second wave occurred in 1927. From the data secured by this 2½% cruise, it is evident that the association of pines with over a thousand feet of live stem of Ribes species per acre almost entirely along streams resulted in 13.5% of the pines becoming infected.

Since the strips studied were not contiguous it is impossible to draw any conclusions relative to the source of infection on any one pine. However, it is believed that such a study gives reliable information on the average pine infection over a large infected area at a relatively small expenditure of time.

If such studies could be made of many infections thruout the country, it is believed that information of value could be obtained relative to the amount of pine infection caused by association of pines with different amounts of Ribes leafage. This information could be used in evaluating Ribes eradication in terms of pine protection until more exact figures are secured from permanent plot studies.

In compiling statistics mentioned in this paper, no attempt has been made to show the distances of spread from Ribes to pines. It is sufficient for the present to observe that the pines found infected were usually close to _R. bracteosum_ locations.

LONG MEADOW CREEK INFECTION AREA, IDAHO

By
H. N. Putnam
Associate Pathologist

PURPOSE

The purpose of the study started at Long Meadow Creek is to determine the effectiveness of Ribes eradication in the control of blister rust under conditions that exist there.

LOCATION

The infection is located near the junction of Long Meadow and Three Bear creeks, Clearwater County, Idaho, township 39 north, range 1 east, section 14.

SITUATION AND WORK DONE

This infection was first found on August 21, 1929, by C. M. Chapman and R. K. Pierson. Subsequent scouting showed that infection covered about 60 acres supporting a dense stand of white pine 21 to 40 years old. Two centers of infection apparently originating in 1923 were found. One of these on Long Meadow Creek, 7 chains above creek junction had approximately 100 trees with cankers originating in 1923. The other spot infection of 1923 origin was on the north-facing slope of Three Bear Creek, 5 chains west of junction. Here it was estimated that there were 75 trees with cankers originating in 1923. Pines with cankers originating in 1926 and 1927 were found extending up Three Bear Creek for a distance of 35 chains; up Long Meadow Creek for 20 chains; and below the junction of the creeks for 4 chains.

It was estimated that on the 60 acres of infected area there were 1,500 trees per acre with an average of 5% of them infected. On this basis it is judged that there were 4,500 trees infected on the total area.

There were found no concentrations of Ribes on or near the infected area. Ribes lacustre and R. viscosissimum occurred at the rate of 30 to 40 bushes per acre, not particularly concentrated along the streams, but scattered through the stand. The nearest R. petiolare found was three miles away, not associated with the rust.

Approximately 300 acres on and around the infected area were eradicated of Ribes by the eradication forces. A check of this eradication work showed the following average Ribes conditions left:

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Approximately 300 acres on and around the infected area were eradicated of Ribes by the eradication forces. A check of this eradication work showed the following average Ribes conditions left:

R. lacustre bushes.................22 per acre
R. lacustre F.L.S..................145 " "
R. viscosissimum bushes............ 7 " "
R. viscosissimum F.L.S............. 85 " "
Total Ribes bushes................. 29 " "
Total Ribes F.L.S..................230 " "

A plot was started late in the season including both centers of infection. An area of 4.1 acres was surveyed into square chains and the Ribes present before eradication plotted and recorded. Information on pines was delayed until next year, owing to the need for Ribes information before the Ribes were eradicated. In Table No. 1 is shown the details of Ribes infection on the plot.

TABLE NO. 1

RIBES INFECTION STUDIED ON LONG MEADOW PLOT, IDAHO

September 1 - 15, 1929

Type of Information	R. viscosissimum	R. lacustre
Bushes per acre before eradication	3	19
Feet live stem per acre before eradication	27	1,881
Total bushes examined	12	78
Per cent bushes infected	83.3	46.2
Per cent leaves infected per infected bush	75.4	22.0
Per cent infection per infected leaf	14.3	4.8
Per cent infected surface bearing telia	19.2	39.3
Per cent total leaf surface bearing telia	1.72	.19
Ratio of telial production for equal leafage units	9	1

It may be observed that in Table No. 1 the percentages of infection in the various steps mentioned are decidedly higher for *R. viscosissimum* than for *R. lacustre* except in the case of the per cent of infected surface bearing telia. In this instance the telial production per infected surface of *R. lacustre* is over twice that of *R. viscosissimum*. This is unusual since past investigations have shown *R. lacustre* to be the lowest of all Ribes species studied in the production of telia per infected surface. A study of relative humidity in connection with Ribes infection may shed light on this situation.

The Ribes examined on the infection area were almost entirely in the half or full shade. Lachmund has reported his studies on relative susceptibility of *R. viscosissimum* and *R. lacustre* in the Western Blister-

R. *lacustre* bushes.....................22 per acre
R. *lacustre* T.L.S.....................145 " "
R. *viscosissimum* bushes............... 7 " "
R. *viscosissimum* T.L.S. .... 85 " "
Total Ribes bushes .... 29 " "
Total Ribes T.L.S.......................230 " "

A plot was started late in the season including both centers of infection. An area of 9.1 acres was surveyed into square chains and the Ribes present before eradication plotted and recorded. Information on pines was delayed until next year, owing to the need for Ribes information before the Ribes were eradicated. In Table No. 1 is shown the details of Ribes infection on the plot.

TABLE NO. 1

RIBES INFECTION STUDIED ON LOST HORSE PLOT, IDAHO

September 1 - 15, 1929

Type of Information	R. *viscosissimum*	R. *lacustre*
Bushes per acre before eradication	2	19
Feet live stem per acre before eradication	37	1,392
Total bushes examined	12	78
Per cent bushes infected	83.3	46.2
Per cent leaves infected per infected bush	75.4	22.0
Per cent infection per infected leaf	14.3	4.6
Per cent infected surface bearing telia	16.0	23.3
Per cent total leaf surface bearing telia	1.72	.15
Ratio of telial production for equal leafage units	9	1

It may be observed that in Table No. 1 the percentages of infection in the various steps mentioned are decidedly higher for R. *viscosissimum* than for R. *lacustre* except in the case of the per cent of infected surface bearing telia. In this instance the telial production per infected surface of R. *lacustre* is over twice that of R. *viscosissimum*. This is unusual since past investigations have shown R. *lacustre* to be the lowest of all Ribes species studied in the production of telia per infected surface. A study of relative humidity in connection with Ribes infection may shed light on this situation.

The Ribes examined on the infection area were almost entirely in the half or full shade. Lachmund has reported his studies on relative susceptibility of R. *viscosissimum* and R. *lacustre* in the Western White

Rust News Letter of December 15, 1928, Volume 3, No. 12. He shows the ratio of telial production for equal amounts of leafage of the two Ribes species in the shade to be R. viscosissimum 4.7, R. lacustre 1. He does not show a value for R. viscosissimum in the half shade. The findings at Long Meadow show the relationship to be R. viscosissimum 9, R. lacustre 1. Thus the findings in eastern B. C. where Lachmund conducted his studies, and the findings at Long Meadow are not dissimilar, so far as the relation in susceptibility of the two Ribes species are concerned.

However, the high percentage of telial development per infected surface of R. lacustre is unusual, and points to the effect of some other factor or factors. To determine if this is due to a more susceptible strain of R. lacustre a few plants heavily infected in 1929 at Long Meadow were transplanted in a defoliated condition to Newman Lake, where R. lacustre did not show severe infection. Future inspections at Newman Lake will shed light on this point.

To determine the effect of relative humidity at Long Meadow as a possible contributing cause of the severe infection of R. lacustre, it is intended to set up a hygrothermograph to measure relative humidity in this region.

Considerable time will be spent in establishing a plot at Long Meadow in 1930.

EAGLE CREEK INFECTION AREA, OREGON

By

H. N. Putnam

Associate Pathologist

PURPOSE

The purpose of a study which might be conducted at Eagle Creek, Oregon would be to determine the effect of stream type eradication upon the action of the rust in Oregon.

LOCATION

This area lies on Eagle Creek, Hood River County, Oregon, 5½ to 7½ miles by trail south of the Columbia River Highway, northwest of Mt. Hood in township 1 north, range 8 east, sections 6, 8, 9.

GENERAL SITUATION

The area of infection lies along Eagle Creek for a distance of two miles. The apparent center of infection is on an alluvial fan on the east side of Eagle Creek seven to seven and one-half miles from the Columbia River Highway, and is reached by trail. The area supports a stand 11 to 20 years old of Douglas fir, with scattered white pines present.

HISTORY OF INFECTION

Pine infection here was found for the first time by Lyle on September 16, 1929. Ribes bracteosum infection was found in this general vicinity in 1927, and on Eagle Creek in 1928. The area was further examined on October 18, 1929, by Goodding and Putnam.

RIBES CONDITIONS

No concentrations of Ribes were found on or near the area. There are scattering R. bracteosum bushes along the creek, but not in abundance. R. sanguineum was found distributed among the pines, but not in great amounts. The bushes were from 10 to 50% defoliated. One out of 15 R. bracteosum bushes examined was found with 5% of its leaves infected. No infection was found on 25 R. sanguineum examined.

PINE INFECTION

There were 50 pines examined, 10 of which were infected. An analysis of 13 cankers on 6 trees showed that probably infection originated in 1925 or 1926, with a secondary wave apparent in 1927. The infected pines were not particularly concentrated in the immediate vicinity of R. bracteosum, but were scattered from 50 to 600 feet distant.

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RECOMMENDATIONS

It is believed that a worth while study of the value of stream type eradication in Oregon could be made here by the removal of R. bracteosum for one mile in each direction, and the establishment of a permanent study plot possibly 5 chains wide along the creek and 15 chains long extending up the slope at right angles to stream flow. The effect of R. sanguineum on the rust could then be studied. Pines and Ribes should be plotted and examined at periodic intervals. It is planned to establish such a plot in the spring of 1930.

PROGRESS REPORT ON STUDIES OF RELATIVE SUSCEPTIBILITY
OF PINUS MONTICOLA AND PINUS STROBUS GROWING UNDER
WESTERN CONDITIONS

By
H. N. Putnam
Associate Pathologist

This paper constitutes a progress report on two plots, one at Buck Creek, Snohomish County, and one at Pysht, Clallam County, Washington, both established in the spring of 1928. This study was first reported in the 1928 Annual Report of this office. The plots were inspected in the fall of 1929. Table No. 1 gives the results of the inspection.

TABLE NO. 1

RELATIVE SUSCEPTIBILITY OF PINUS MONTICOLA AND PINUS STROBUS ON THE BUCK CREEK AND PYSHT AREAS, WASHINGTON. OCTOBER 1929

Plots	White Pine Species	Number of Trees Examined	Number of Trees Infected	Per Cent Trees Infected	Average Cankers Per Infected Tree	Average Cankers Per Total Trees	Cankers Per 1000 Ft. of Needle Stem
Buck Creek	P. monticola	70	50	71.4	13.8	9.8	17.8
	P. strobus	5	1	20.0	4.0	0.8	1.9
Pysht	P. monticola	74	69	93.2	14.0	13.0	53.2
	P. strobus	5	4	80.0	12.5	10.0	5.8
Combined Plots	P. monticola	144	119	82.6	13.9	11.5	29.1
	P. strobus	10	5	50.0	10.8	5.4	5.1

It is evident from Table No. 1 that considering both plots together, for equal volumes of foliage there were found nearly 6 times as many cankers on P. monticola as on P. strobus indicating that P. strobus is much more resistant to the rust than is P. monticola when both are exposed to the same sporidial sources. This fact is of importance not only in considering the two species with reference to reforestation needs, but also it is useful in interpreting eastern infection information for use in western work.

In 1928 the ratio of cankers for equal volumes of foliage on these same plots was 3 cankers on P. monticola to 1 canker on P. strobus.

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Plots	White Pine Species	Number of Trees: Exam-ined	Number of Trees: In-fected	Per Cent Trees Infect-ed	Average Cankers Per: Infected Tree	Average Cankers Per: Total Trees	Cankers P[er] 1000 Ft. [of] Needle St[em]
Buck Creek	P. monticola	70	50	71.4	13.7	9.8	17.8
	P. strobus	5	1	20.0	4.0	0.8	1.[illegible]
Pysht	P. monticola	74	69	93.2	14.0	13.0	53.[illegible]
	P. strobus	5	4	80.0	12.5	10.0	5.[illegible]
Combined Plots	P. monticola	144	119	82.6	13.9	11.5	29.[illegible]
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GENERAL SUMMARY OF WORK DONE IN PROJECT 4.2 AND PLANS FOR THE FUTURE

By

H. N. Putnam
Associate Pathologist

Results of studies, with reference to the relationship of Ribes quantities and cankers produced, are shown in Table No. 1.

TABLE NO. 1

NUMBER OF CANKERS CHARGEABLE TO FEET OF LIVE STEM OF RIBES BY SPECIES

		Cankers Originating		Feet of Live Stem Per Acre Of					
Area	Acres Studied	In 1923	Since 1923	R. pet.	R. bract.	R. iner.	R. sang.	R. lac.	Total Ribes
Buck Creek Washington	1.6	25	660		936			2,253	3,189
Rhododendron Oregon	35.17	125	1,378		419		125	527	1,071
Deep Creek Idaho	?	3	2	11,944				5,314	17,258
N.Fork Reed's Creek, Idaho	?	0	22	24,266				9,422	33,688
Newman Lake Washington	25.4	43	512			3,155		2,118	5,273
Long Meadow Idaho	4.1	5*	123				R.vis. 27	1,881	1,908

*Numbers of cankers represented here are only those which were classified as to year of origin and stage of canker development.

An examination of Table No. 1 brings out the obvious fact that factors other than the ability to produce telia are very influential in causing pine infection. Observations at different points have indicated that relative humidity is an important factor in producing pine infection. It is intended that relative humidity readings will be taken on every plot studied in the future.

It is believed that the index to the effect of all factors applying to any area is the rate of increase in number of cankers produced in one wave of infection over that of the preceding wave. Hence the real purpose of Ribes eradication is to reduce the rate of increase in number

of cankers to a minimum. Absolute removal of all Ribes from an area, would of course reduce the rate of increase to zero.

We are striving to shape our studies toward the development of two reference tables. One of these would contain data relative to the rate of increase in number of cankers of one wave of infection over the preceding wave as indicated by a correlation of relative humidity and quantities of a given Ribes species. The other reference table would show the average number of cankers required to render trees of different size classes unmerchantable.

With such information on a sufficient basis, it should be possible to intelligently estimate the effectiveness of eradication on a given area in terms of pine protection.

The costs of project 4.2 are shown in the "Checking Report". The estimated total charged to a study of infection plots in 1929 is $8,317.26.

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With such information on a sufficient basis, it should be possible to intelligently estimate the effectiveness of eradication on a given area in terms of pine protection.

The costs of project 4.2 are shown in the "Checking Report". The estimated total charged to a study of infection plots in 1929 is $2,317.26.

EDUCATIONAL WORK - 1929

By

R. L. MacLeod,

Agent

INTRODUCTION

The educational program of the Western Office of Blister-Rust-Control has been carried on largely in those western states where the protection of white pine is an economic concern and in which blister-rust control is being developed. Work in other regions has consisted in giving attention to definite requests for blister-rust material and information.

Educational work in Montana, Oregon and California has been carried on by the state leader concerned, with the aid of specimens, display material and bulletins supplied from the Spokane Office. As this work is treated in the reports of the state leaders this report deals only with the educational work of the Spokane Office.

PURPOSE

The purpose of educational work is to give to blister-rust workers a comprehensive view of the relation of the projects and up-to-date information on the general progress and results of the work; to bring to the administrators of forest lands, both public and private, a realization of the menace to white pine which blister rust constitutes and of the necessity for action in preserving both actual and potential timber assets and to supply those not directly concerned with the control of blister rust with some knowledge of the disease and of the progress and value of control efforts in order to build up general interest in and support of the control program.

SUMMARY OF WORK

The educational work accomplished during 1929 falls under two general headings: 1. preparation of material; 2. distribution of material and information.

A. Preparation of Material

1. Blister-Rust Specimens. One of the most valuable aids to the dissemination of blister-rust information is the distribution of actual specimens of the disease. A sound conception of the importance and practicability of control work is predicated on a foundational knowledge of the disease itself which can well be provided through the illustrative use of specimens.

Cankers showing the early development and aecial stages of the disease on pine were preserved in individual test tubes. 475 of these specimens were used in demonstration boxes, 55 aecial stage specimens were sent to state leaders and 60 to schools and colleges.

Several trunk cankers, 18 and 24 inches long, in large glass jars and a number of the larger branch cankers in one-quart jars were used in demonstration work.

Several hundred diseased Ribes leaves showing both the uredinial and telial stages were gathered. Of these, two hundred of each stage were used in demonstration boxes, 80 individual mounts of uredinial and 50 of telial specimens were supplied to state leaders and 45 of each stage were sent to educational institutions. A sufficient quantity of these specimens has been left on hand to supply educational needs during the first half of 1930.

A large quantity of uredinial and telial specimens was preserved in test tubes, one tube of each stage, containing 20 to 25 leaves, to be sent to the universities of the West for microscopic examination of spores, in the classroom.

All specimens sent out from the Spokane Office, whether for display or for class study, have been so treated as to preclude the possibility of viable spores or mycelium remaining in the material. At the time of collection, the specimens are immersed in the standard killing solutions used by the Office of Blister-Rust Control, composed as follows:

Solution for pine specimens - 2 per cent formaldehyde, 10 per cent glycerine and 88 per cent water.
Solution for Ribes specimens - 5 per cent formaldehyde, 5 per cent glacial acetic acid and 90 per cent of a 50 per cent solution of alcohol.

Display tubes containing aecial or pycnial material are tightly corked and sealed with wax. Ribes mounts of uredinial or telial material are tightly sealed at the edges with tape, the material having previously been disinfected with the killing solution. By these means, every possible precaution is taken to prevent dissemination of the rust.

Demonstration Boxes. Two types of demonstration box have been designed during the past two years; a 3-specimen box showing the three most easily recognizable stages of the disease on Ribes and pine, the uredinial, telial and aecial stages and a 7-specimen box showing all stages of the disease on both hosts.

The 3-specimen box was made up in 1928 when 40 were used by state leaders and 24 sent out from the Spokane Office. During 1929, 14 of these boxes were supplied to state leaders, 36 to Forest Service officials and 3 to schools. In the fall of the year 75 of these boxes were made up for use during 1930.

The 7-specimen box was developed in the fall of 1928 when 12 were made up and 7 distributed to state leaders and collaborators. During 1929, 28 of these boxes were sent to state leaders, 17 to administrators of forest lands, 6 to educational institutions and 9 to blister-rust camps. 20 of these 7-specimen boxes remain on hand and a greater supply will be made up as soon as an additional supply of material can be gathered in the spring of 1930.

Photography. Photography plays an important part in educational work in that a supply of good photographs is prerequisite to the making of lantern slides, posters, bulletins and other demonstration and publicity material.

During the winter months photographic work consists in the reduction of maps, charts and tables for the annual report, for publication and for lantern slides. Early in the year, 35 pictures were taken for the 1928 annual report and 26 graphs were reproduced for publication.

During the field season an effort is made to procure an up-to-date record of the work of each project. Pictures are taken of working areas, methods in use and, so far as practicable, of results. In addition Ribes, white-pine stands and general forest types are photographed. During 1929 there were added to the western files 175 field photographs from which a number of lantern slides and enlargements will be procured.

Blister-Rust Albums. Albums showing the important features of the several phases of blister-rust work, with explanatory legends, were prepared in the spring of the year. Eight of these albums were made up and used in blister-rust camps during the summer.

Sets of Photographs and Bulletins. A set of photographs was prepared showing the life cycle and spread of the rust, damage to pine and methods of control. Comprehensive legends were written giving up-to-date information supplementary to that contained in bulletins. These sets of photographs with bulletins were included with demonstration material for universities and were sent to students requesting information for theses on blister rust.

The 4-specimen box was made up in 1928 when 40 were issued to state leaders and 26 sent out from the Spokane Office. During 1928, 14 of these boxes were supplied to state leaders, 26 to Forest Service officials and 3 to schools. In the fall of the year 75 of these boxes were made up for use during 1930.

The 7-specimen box was developed in the fall of 1928 when 12 were made up and 7 distributed to state leaders and collaborators. During 1929, 35 of these boxes were sent to state leaders, 17 to administrators of forest lands, 6 to educational institutions and 8 to blister rust camps. 20 of these 7-specimen boxes remain on hand and a greater supply will be made up as soon as an additional supply of material can be gathered in the spring of 1930.

Photography. Photography plays an important part in educational work in that a supply of good photographs is prerequisite to the making of lantern slides, posters, bulletins and other demonstration and publicity material.

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Bulletins. The bulletins used in educational work during the past year were:

Miscellaneous Publication No. 23 - general bulletin dealing with blister rust.

Reprint from "The Timberman" - White-Pine Blister Rust - Its Cause and Control in the West.

Miscellaneous Publication No. 27 - Black Currant Spreads White-Pine Blister Rust.

Technical Bulletin No. 87 - White-pine Blister Rust: A Comparison of European with North American Conditions.

Farmers' Bulletin No. 1398 - Currants and Gooseberries - Their Culture and Relation to White-Pine Blister Rust.

Questions and Answers - dealing with blister-rust control.

Five-winged Panels. Early in 1929 the posters on the five-winged panels were revised. Five new posters were designed and two copies of each made up. One copy was kept for demonstration work, the other sent to Washington where copies were made for all panels. These posters were received in the fall of the year and are being used in the revision of panels in the possession of state leaders and collaborators.

Photographs, 8"x10", were taken of the posters on the five-winged panel and arranged in the same way, i.e., as a panel. It is planned to have these smaller panels printed in Washington and distributed with demonstration material for schools.

Blister-Rust Posters. A large poster, 26"x38", was made up with photographs showing the life cycle and spread of blister rust, damage pictures, control methods and values at stake. Printing of borders, heads and legends will be done in Washington. These posters should be available in the fall of 1930 for state leaders, Forest Supervisors' offices and educational institutions.

B. Distribution of Material and Information.

Blister-Rust Personnel. An important phase of educational work is the dissemination of news to blister-rust workers in order that they may comprehend fully the importance of all developments in the ramified field of blister-rust activities.

Bulletins. The bulletins used in educational work during the past year were:

Miscellaneous Publication No. 22 - general bulletin dealing with blister rust.

Reprint from "The Timberman" - White-Pine Blister Rust - Its Cause and Control in the West.

Miscellaneous Publication No. 27 - Black Currant Spreads White-Pine Blister Rust.

Technical Bulletin No. 87 - White-pine Blister Rust: A Comparison of European with North American Conditions.

Farmers' Bulletin No. 1398 - Currants and Gooseberries - Their Culture and Relation to White-Pine Blister Rust.

Questions and Answers - dealing with blister-rust control.

Five-winged panels. Early in 1928 the posters on the five-winged panels were revised. Five new posters were designed and two copies of each made up. One copy was kept for demonstration work, the other sent to Washington where copies were made for all panels. These posters were received in the fall of the year and are being used in the revision of panels in the possession of state leaders and collaborators.

Photographs, 8"x10", were taken of the posters on the five-winged panel and arranged in the same way, i.e., in a panel. It is planned to have these smaller panels printed in Washington and distributed with demonstration material for schools.

Blister-Rust Posters. A large poster, 26"x38", was made up with photographs showing the life cycle and spread of blister rust, damage pictures, control methods and values at stake. Printing of borders, heads and legends will be done in Washington. These posters should be available in the fall of 1930 for state leaders, forest supervisors' offices and educational institutions.

4. Distribution of Material and Information.

Blister-Rust Personnel. An important phase of educational work is the dissemination of news to blister-rust workers in order that they may comprehend fully the importance of all developments in the ramified field of blister-rust activities.

The Western Blister-Rust News Letter was initiated to fill this need and was continued throughout 1929. Articles were written on blister rust and associated forestry subjects, the former dealing with plans, aims and periodic results of the various projects. Articles were contributed by practically all of the permanent personnel. The news letter averaged 9 pages in length and was issued to a mailing list of 60, most of whom are concerned directly with blister-rust work.

During the summer months the mailing list was expanded to include all temporary employees. This summer news letter averaged 15 pages in length. Impressions of the men were given in prose and poetry. Interspersed with these items were more serious articles giving the purpose, plans and results of the work.

Each blister-rust camp was supplied with bulletins, one album and one 7-specimen demonstration box which proved of value in helping the temporary men to comprehend the scope and importance of the work.

U. S. Forest Service. 7-specimen boxes were supplied to the seven forest supervisors and 3-specimen boxes to the 36 ranger stations on the Clearwater, Coeur d'Alene, Kaniksu, Pend Oreille, Selway and St. Joe National Forests. One 7-specimen box was sent to the Supervisor, Nezperce National Forest and one to the Director, Priest River Experiment Station. Copies of blister-rust bulletins were supplied with each demonstration box. This demonstration material should prove useful in aiding the Forest Service personnel to understand and recognize blister rust. It has been used also by some forest supervisors in display work.

In addition, some demonstration work was done with the Forest Service personnel. A lantern slide talk was given at the guard training school of the Pend Oreille National Forest in May. During the summer 6 supervisors' offices and 11 ranger stations were visited with demonstration material comprising a five-winged panel, photographs and large trunk cankers.

Timber Protective Associations. The secretaries of the Clearwater, Coeur d'Alene, Pend Oreille, Potlatch and Priest Lake Timber Protective Associations were supplied with 7-specimen boxes and bulletins. The secretaries of the Potlatch and Clearwater Associations were visited with demonstration material, the large trunk cankers being of particular interest in demonstrating potential damage to white pine. The Chief Fire Warden of the Potlatch Association was supplied with a 7-specimen box and bulletins. These boxes will be sent to the fire wardens of all associations when an additional supply is made up.

The Western Blister-Rust News Letter was initiated to fill this need and was continued throughout 1950. Articles were written on blister rust and associated forestry subjects, the former dealing with plans, aims and periodic results of the various projects. Articles were contributed by practically all of the permanent personnel. The news letter averaged 9 pages in length and was issued to a mailing list of [illegible], most of whom are concerned directly with blister-rust work.

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National Parks. Bulletins and 7-specimen boxes were sent to the superintendents of eight national parks in the West. Five of these boxes were sent to state leaders for transmittal to the superintendents of Crater, General Grant, Lassen, Sequoia and Yosemite National Parks. Three boxes with bulletins were sent from this office to the superintendents of Glacier, Rocky Mountain and Yellowstone National Parks. Rainier National Park had been supplied with two 3-specimen boxes and bulletins in 1928.

Educational Institutions. A set of demonstration material was prepared for the universities of the West. This set includes one 7-specimen demonstration box, 6 individual mounts of both uredinial and telial material for classroom use, 2 test tubes containing preserved uredinial and telial material for microscopic examination and one set of photographs and bulletins.

This material was supplied to the School of Forestry and Department of Plant Pathology, University of Idaho; Agricultural Department, Southern Branch, University of Idaho; Departments of Forestry and Plant Pathology, Washington State College and the School of Forestry, University of Washington. This material is useful in supplying a cumulative number of students with a fundamental knowledge of blister rust. It will be used also at various times in extention work displays.

In addition to the material noted above one 7-specimen box and bulletins were supplied the Department of Forestry, Utah Agricultural College; 6 aecial specimens, 3 first stage cankers on pine and bulletins were sent to Cornell University and sets of photographs and bulletins were supplied to ten students requesting information on blister rust.

Superintendents and teachers in 5 public schools were supplied with three 3-specimen boxes, 12 aecial, 6 uredinial and 6 telial specimens and copies of all bulletins.

General Publicity. Articles were run in newspapers in Spokane, Washington and in Coeur d'Alene, Elk River, Lewiston and Orofino, Idaho. Five cuts with legends and bulletins were sent to the Chief of the Montana State Agricultural Department for publicity work.

Blister-rust talks, illustrated with lantern slides were given before a nature study club and the Hoo Hoo Club in Spokane, Washington.

Blister-rust demonstrations were prepared for the Sportmen's and Tourists' Fair at Spokane, Washington, in May, the Bonner County Fair at Sandpoint, Idaho in September and the Clearwater County Fair at Orofino, Idaho in October. Demonstration material comprised actual specimens of white pine, Ribes and blister rust, one five-winged panel, enlarged photographs, large trunk cankers and colored lantern slides which proved quite effective in attracting attention to the display and in telling the story of blister rust and its control.

RECOMMENDATIONS

To further the carrying out of plans formulated for educational work in 1930 it is recommended that:

1. An automatic slide projector be procured. This would greatly increase the effectiveness of county fair demonstrations.

2. Batteries be provided for the projection machine now in use. This would facilitate educational work in blister-rust camps and Forest Service stations where no electricity is available.

Blister-rust demonstrations were prepared for the Northern and Tourists' Fair at Spokane, Washington, in May, the Bonner County Fair at Sandpoint, Idaho in September and the Clearwater County Fair at Orofino, Idaho in October. Demonstration material comprised actual specimens of white pine, Ribes and blister rust, one five-winged panel, enlarged photographs, large trunk cankers and colored lantern slides which proved quite effective in attracting attention to the display and in telling the story of blister rust and its control.

RECOMMENDATIONS

To further the changing of white pine [illegible] for educational work in 1937 it is recommended that:

1. An automatic slide projector be procured. This would greatly increase the effectiveness of county fair demonstrations.

2. Batteries be provided for the projection machine now in use. This would facilitate educational work in blister-rust camps and Forest Service stations where no electricity is available.

EXPENDITURES

of

[illegible]

Calendar Year [illegible]

Federal Expenditures

The following tabulations of Federal expenditures for the periods January - June, [illegible], and July - December [illegible] summarize, by project, the expenditures of the Eastern Office of Blister-Rust Control.

Expenditures have been classified under the several heads shown in the tabulations for the purpose of better evaluating items of expense charged to each project in preparing project cost allotments. To further this objective office records show the classification of all expenditures by object.

TABLE NO. 1.

FEDERAL EXPENDITURES, WESTERN OFFICE OF BLISTER-RUST CONTROL,
January 1, 1929 - June 30, 1929.

	Project	Salaries	Expenses	Total	Subsistence Expenses	Railroad, Pullman, Stage, etc.	Personally Owned Autos	Operation Government Ford Trucks	Other Transportation Expenses	Express, Freight, Trucking and Packing	Supplies and Equipment	Miscellaneous Expenses
1.1	Cultivated black currant location and eradication in cooperation with states -											
	1.11 - Montana	$ 150.00	-	$ 150.00	-	-	-	-	-	-	-	-
	1.15 - California	528.33	$ 23.66	551.99	$ 10.35	-	-	-	$ 1.00	$ 1.71	-	$ 10.60
1.2	Inspection of transported host plants in cooperation with the Plant Quarantine & Control Administration	567.50	9.05	596.55	-	-	-	$ 9.05	-	-	-	-
1.3	Sanitation of Nurseries -											
	1.34 - Oregon	50.00	-	50.00	-	-	-	-	-	-	-	-
2.2	Developing methods of Ribes eradication -											
	2.22-1 - Method studies of chemical eradication	988.20	3,373.75	4,361.95	311.91	-	$ 17.32	8.24	.10	365.95	*$2,317.36	352.87
	2.22-2 - Experimental re-eradication Bovill, Idaho	156.34	367.20	525.54	106.69	-	-	20.85	-	17.66	193.26	28.74
	2.22-3 - Experimental re-eradication Coeur d'Alene National Forest	558.33	465.82	1,024.15	199.39	-	-	5.00	-	35.39	194.58	31.46
2.3	Developing and testing Ribicides -											
	2.3-1 - Laboratory investigations	5,603.15	1,649.48	7,252.63	445.53	$ 128.14	90.30	77.50	44.40	93.20	570.63	199.78
	2.3-2 - Field tests	340.76	769.64	1,110.40	145.55	-	11.62	110.67	-	5.23	479.26	17.31
2.4	Studies in Ribes ecology -											
	2.42 - Idaho	3,329.58	890.05	4,219.63	328.86	155.49	201.46	31.89	12.60	4.65	146.75	8.35
	2.44 - Oregon	25.00	95.37	120.37	52.22	12.05	30.59	-	.16	-	-	.35
	2.45 - California	419.99	353.99	773.98	130.29	16.87	-	35.86	1.79	7.22	129.79	32.17
3.0	Application of chemical eradication of Ribes -											
	3.02 - Idaho	4,176.31	3,258.37	7,434.68	1,363.50	1,205.57	241.43	61.34	46.90	42.31	98.58	198.74
3.1	Control Reconnaissance on Federal lands -											
	3.11 - Montana	260.00	-	260.00	-	-	-	-	-	-	-	-
	3.12 - Idaho	827.48	32.15	859.63	-	-	-	-	-	-	-	32.15
	3.15 - California	1,782.74	803.57	2,586.31	367.82	51.25	94.55	89.88	4.89	8.64	134.87	51.67
3.2	Ribes eradication - Federal lands											
	3.21 - Montana	1,317.50	512.29	1,829.79	15.15	-	73.99	-	-	22.82	* 389.16	11.17
	3.22 - Idaho	2,069.11	105.27	2,174.38	10.50	-	-	5.06	-	-	3.60	85.11
	3.23 - Washington	95.00	34.45	129.45	34.05	-	-	-	.40	-	-	-
	3.24 - Oregon	1,091.53	732.35	1,823.88	222.03	12.06	295.68	-	21.31	21.77	121.10	38.40
	3.25 - California	3,153.88	1,730.65	4,884.53	887.88	69.23	63.51	79.54	12.96	85.55	398.54	133.44
3.3	Control demonstrations on private lands -											
	3.32 - Idaho	1,291.66	7.45	1,299.11	-	-	-	-	-	-	-	7.45
3.4	Cooperative Ribes eradication -											
	3.42 - Priest Lake Timber Protective Association	333.32	51.64	384.96	6.55	-	-	.85	-	-	-	44.24
	3.42-1 - Clearwater Timber Protective Association **	995.66	6,149.15	**7,144.81	1,283.57	118.82	-	43.40	-	402.68	* 4,199.17	101.51
	3.42-2 - Potlatch Timber Protective Association **	1,056.64	4,603.29	**5,659.93	97.09	-	-	30.45	.39	163.14	* 4,179.49	132.73
4.1	Spread of the rust -											
	4.11 - Montana	-	24.70	24.70	-	-	-	-	-	1.20	20.99	2.51
	4.12 - Idaho	266.66	119.37	386.03	51.00	-	38.99	-	-	1.20	21.03	7.15
	4.13 - Washington	133.33	24.58	157.91	-	-	-	-	-	1.20	20.90	2.48
	4.14 - Oregon	-	24.61	24.61	-	-	-	-	-	1.21	20.87	2.53
	4.16 - British Columbia	133.33	-	133.33	-	-	-	-	-	-	-	-
4.2	Damage to pine	2,438.59	545.47	2,984.06	174.38	34.48	170.80	31.81	1.64	4.65	122.08	5.63
6.	Educational work -											
	6.0 - Spokane Office	2,721.48	898.30	3,619.78	360.39	174.42	64.33	-	8.85	47.78	136.46	106.07
9.	Maintenance of field office and miscellaneous expense -											
	9.1 - Supervision	2,299.98	757.72	3,057.70	203.36	535.10	-	-	18.10	-	-	1.16
	9.2 - Office maintenance	6,479.96	1,736.55	8,216.51	2.55	32.58	-	-	2.45	-	-	1,698.97
	9.3 - Miscellaneous supplies and services paid on L/A	-	775.43	775.43	-	-	12.25	2.46	-	57.57	323.03	380.12
	9.4 - Miscellaneous supplies paid in Washington #	-	92.01	## 92.01	-	-	-	-	-	21.73	70.28	-
Total		$45,663.34	$31,017.38	$76,680.72	$6,810.61	$2,546.06	$1,406.82	$644.85	$177.94	##$1,414.46	$14,291.78	$3,724.86

*Includes cost of Atlacide for entire field season of 1929.
**See also separate summary of expenditures from association funds for these cooperative projects.
Stationery and other office supplies in the amount of $43.63 furnished this office from Washington, D. C., the cost of which is allocated to the "General Control Program" and is not included in the total for this project.
Includes operation of G.W.C. truck for projects 2.22-2, 2.22-3, 3.42-1, 3.42-2.
Outstanding freight and express items for various projects, estimated at $150.00, not included.

Annual Report 1929
M. L. McWold

TABLE NO. 2.

FEDERAL EXPENDITURES, WESTERN OFFICE OF BLISTER-RUST CONTROL,
July 1, 1929 - December 31, 1929.

	Projects	Salaries	Expenses	Total	Subsistence Expenses	Railroad, Pullman, Stage, etc.	Personally Owned Autos	Operation Government Ford Trucks	Other Transportation Expenses	Express, Freight, Trucking and Packing	Supplies and Equipment	Miscellaneous Expenses
1.1	Cultivated black currant location and eradication in cooperation with states 1.15 - California	$ 2,194.83	$ 2,684.65	$ 4,879.48	$ 1,247.81	$ 44.07	$ 1,342.74	-	$ 2.40	$ 3.72	$ 13.90	$ 30.01
2.2	Developing methods of Ribes eradication 2.22-1 - Method studies of chemical eradication	5,038.90	2,126.40	7,165.30	800.51	29.92	65.94	$ 74.00	.48	235.98	562.30	357.27
	2.22-2 - Experimental re-eradication, Bovill, Idaho	2,899.95	678.60	3,578.55	501.60	5.23	57.12	20.25	.10	26.95	22.41	44.94
	2.22-3 - Experimental re-eradication, Coeur d'Alene National Forest	3,058.09	977.02	4,035.11	733.79	34.00	-	-	-	48.30	124.80	36.13
2.3	Developing and testing Ribicides 2.3-1 - Laboratory investigations	4,445.87	2,395.56	6,841.43	711.45	569.43	317.13	77.06	25.16	54.97	472.72	167.64
	2.3-2 - Field tests	1,068.48	1,342.88	2,411.36	652.66	-	49.00	-	15.00	41.23	523.14	61.85
2.4	Studies in Ribes ecology 2.42 - Idaho	3,572.60	1,364.19	4,936.79	651.53	102.67	524.30	20.99	32.65	-	18.63	13.42
	2.45 - California	1,713.03	696.80	2,409.83	443.93	31.61	-	61.61	.70	8.36	117.73	32.86
3.1	Control reconnaissance on Federal lands 3.15 - California	2,091.86	575.00	2,666.86	388.88	23.91	-	81.20	.45	5.59	13.05	61.92
3.2	Ribes eradication on Federal lands 3.21 - Montana	2,529.62	1,029.07	3,558.69	660.46	63.43	213.29	-	1.35	2.50	86.38	1.66
	3.24 - Oregon	3,511.31	1,855.24	5,366.55	826.65	37.00	871.50	-	3.70	35.16	68.70	12.53
	3.25 - California	8,079.91	3,364.28	11,444.19	2,822.52	79.05	107.24	79.39	8.04	4.71	201.62	61.71
3.4	Cooperative Ribes eradication 3.42-1 - Clearwater Timber Protective Association *	5,802.84	1,873.74	* 7,676.58	1,185.97	11.94	31.71	190.34	-	229.61	150.41	73.76
	3.42-2 - Potlatch Timber Protective Association *	5,896.22	2,373.63	* 8,269.85	1,275.22	4.00	-	238.66	-	525.63	146.99	183.13
4.1	Spread of the rust 4.11 - Montana	487.33	268.04	755.37	103.30	10.50	142.45	-	9.24	-	.60	1.95
	4.12 - Idaho	853.84	407.40	1,261.24	217.99	7.86	173.60	7.28	.67	-	-	-
	4.13 - Washington	197.56	42.71	240.27	23.25	-	19.46	-	-	-	-	-
	4.14 - Oregon	1,204.96	902.57	2,107.53	528.90	76.30	258.65	-	20.64	3.00	4.28	10.80
	4.15 - California	458.06	326.55	784.61	123.44	33.47	164.64	-	3.74	.36	.50	.40
4.2	Damage to pine	4,145.22	1,565.65	5,710.87	870.88	123.26	511.21	16.73	20.19	-	12.18	11.20
6.	Educational work	2,509.99	1,041.23	3,551.22	192.34	186.02	255.85	12.33	11.45	-	140.42	242.82
9.	Maintenance of field office and miscellaneous expense 9.1 - Supervision	2,299.98	513.06	2,813.04	121.35	367.71	-	-	23.60	-	-	.40
	9.2 - Office maintenance	6,899.96	2,158.07	9,058.03	207.20	195.37	-	-	3.65	-	-	1,751.85
	9.3 - Miscellaneous supplies and services paid on L/A	-	354.67	354.67	-	-	9.87	2.25	-	38.32	230.60	73.63
	9.4 - Miscellaneous supplies paid in Washington	-	953.95	953.95	-	-	-	-	-	17.00	936.95	-
Total		$70,960.41	$31,870.96	$102,831.37	$15,291.63	$2,036.75	$5,115.70	$882.09	$183.21	**$1,281.39	$3,848.31	$3,231.88

*See also separate summary of expenditures from Association funds for these projects.
**Includes operation of G.M.C. truck for projects 2.22-2, 2.22-3, 2.3-2 and 3.42-2.
Outstanding freight and express charges for various projects estimated at $375.00 not included.

Cooperative Expenditures.

The following table summarizes the expenditure of cooperative funds on Ribes eradication by the Potlatch and Clearwater Timber Protective Associations.

The association funds were deposited as a special account in the U. S. Treasury and disbursed by the Western Office of Blister-Rust Control.

TABLE NO. 3.

SUMMARY OF BLISTER-RUST CONTROL COOPERATIVE RIBES ERADICATION EXPENDITURES
By the
CLEARWATER AND POTLATCH TIMBER PROTECTIVE ASSOCIATIONS
June 10, 1929 - October 20, 1929.

Cooperating Agency	Salary	Expense	Total	Subsistence Supplies	Miscellaneous Supplies and Services
June 10-30, 1929.					
Clearwater Timber Protective Association	$ 895.77	$ 744.49	$ 1,640.26	$ 641.74	$ 102.75
Potlatch Timber Protective Association	930.13	615.65	1,545.78	547.49	68.16
Total June 10-30	$ 1,825.90	$1,360.14	$ 3,186.04	$1,189.23	$ 170.91
July 1 - October 20, 1929.					
Clearwater Timber Protective Association	$ 6,076.87	$1,554.56	$ 7,631.43	$1,358.46	$ 196.10
Potlatch Timber Protective Association	6,261.56	1,948.63	8,210.19	1,914.42	34.21
Total July 1-October 30	$12,338.43	$3,503.19	$15,841.62	$3,272.88	$ 230.31
GRAND TOTAL	$14,164.33	$4,863.33	$19,027.66	$4,462.11	$ 401.22

	Allotment	Expended	Balance
Clearwater Timber Protective Association..........................	$10,000.00	$9,271.69	$728.31
Potlatch Timber Protective Association	10,000.00	9,755.97	244.03
Total............................	$20,000.00	$19,027.66	$972.34

For Federal expenditures on these projects see projects 3.42-1 and 3.42-2 on statements of Western Federal Blister-Rust Control expenditures, January 1, 1929 - June 30, 1929, and July 1, 1929 - December 31, 1929.

GENERAL SUMMARY

I. Delaying Spread of the Rust.

A. Cultivated Black Currant Eradication.

California - 160 bushes eradicated from 22 plantings in 4 counties; 6 bushes from 3 plantings in reworking one county. Work completed in 52 3/4 of the 58 counties.

II. Development of Local Control Practice.

A. Field Study of Methods of Chemical Eradication.

Morro Creek, California - Experimental work carried on during January and February, 1929 for further development of methods and equipment used in both knapsack and power spraying. Results were of direct value in providing efficient equipment, in training permanent personnel and in deciding to use knapsack spraying on major application projects with further experimental work with power spraying.

B. Re-eradication.

1. Idaho.

a. Hand - On the Coeur d'Alene National Forest 4,699.8 acres were re-eradicated at a cost of $.59 on area worked in 1926 at a cost of $2.41 per acre 43.9 Ribes (92% seedlings) and 46 feet of live stem per acre were pulled in 1929; 186.3 bushes and 2,794 feet of live stem per acre in 1926. Amount of live stem left was so small that re-eradication could be delayed four or five years after first eradication.

b. Chemical. On the East Fork of Potlatch Creek 336.5 acres were worked, 219.3 acres of which was a re-eradication of the area sprayed in 1928. It was found that seedlings come in the first year after eradication in great numbers; 58 per cent of Ribes found were seedlings, 27 per cent surviving bushes and 15 per cent sprouts. A 20 per cent solution of sodium chlorate proved to be the most effective spray used in 1928.

2. Washington - Wind River Nursery - Work was confined to stream type where Ribes were heavily concentrated in 1928. 345 Ribes and 6,058 feet of live stem were removed from an area which yielded 5,747 bushes and 40,778 feet of live stem in 1928.

3. California - Three 15-acre Forest Service plots studied to check Ribes regeneration 3 years after original eradication and to study effect of different methods of logging on Ribes establishment. 30 Ribes per acre eradicated in 1926; in 1929, 7.98 bushes (3.54 missed bushes,

3.49 sprouts and .85 seedlings) per acre and 33.24 feet of live stem per acre were eradicated.

C. Development and Testing of Ribicides.

1. Chemical Investigation.

a. Results of Tests of Ribicides in 1928.

Idaho - Alkaline chlorate sprays showed best results on *R. inerme*. Sprays most effective on *R. inerme* also most effective on *R. lacustre*. *R. viscosissimum* susceptible to a 15 per cent chlorate solution at pH of 6.8.

Oregon - Chlorate sprays of less than 15 per cent relatively ineffective on *R. bracteosum*. A complete kill obtained on *R. lacustre*.

California - *R. roezli* resistant to a large range of spray formulae. *R. nevadense* susceptible to a mixture of sodium chlorate and furfural. Sodium chlorate alone is more effective on both *R. roezli* and *R. nevadense* than mixtures of sodium chlorate with calcium chloride or with ammonium chloride in acid and alkaline solutions.

b. Tests of Ribicides, 1929. Field tests were carried on with variations of chlorate solutions and complex salts of heavy metals, specific formulae resulting from enlarged program of investigative work in the laboratory. In Idaho, 40 spray solutions were tested on *R. inerme* and *R. lacustre*; in Oregon, 26 different solutions were sprayed on *R. bracteosum*, *R. sanguineum* and *R. triste* and in California, 27 formulae were tested on *R. roezli*, *R. nevadense* and *R. cereum*. While definite data on the effect of these sprays cannot be procured until 1930, late season observations indicate that complex X is more effective than complex Y on Ribes in all three states.

c. Laboratory Investigations. A comprehensive investigative program has been continued at Berkeley, California to solve pertinent problems of a chemical, physiological and morphological nature.

2. Experimental Application of Ribicides.

41 solutions were sprayed on 141 plots at Clarkia, Idaho to test the effectiveness of various sprays, to test the relationship between time of application during day and effectiveness of sprays and to determine seasonal effect on toxicity of chemicals, definite results to be determined in 1930.

D. Studies in Ribes Ecology.

1. Inland Empire - Additional findings of this project are:

3.42 sprouts and .85 seedlings) per acre and 2.54 days of live area per acre were eradicated.

C. Development and Testing of Ribicides.

1. Chemical Investigations.

a. Results of Tests of Ribicides in 1932.

Idaho - Alkaline chlorate sprays showed best results on R. inerme. Sprays most effective on R. inerme also more effective on R. lacustre. R. viscosissimum susceptible to a 10 per cent chlorate solution at pH of 8.5.

Oregon - Chlorate sprays of less than 15 per cent relatively ineffective on R. bracteosum. A complete kill obtained on R. lacustre.

California - R. roezli resistant to a large range of spray formulae. R. nevadense susceptible to a mixture of sodium chlorate and furfural. Sodium chlorate alone is more effective on both R. roezli and R. nevadense than mixtures of sodium chlorate with calcium chloride or with ammonium chloride in acid and alkaline solutions.

b. Tests of Ribicides, 1933. Field tests were carried on with variations of chlorate solutions and complex salts of heavy metals, specific formulae resulting from enlarged program of investigative work in the laboratory. In Idaho, 40 spray solutions were tested on R. inerme and R. lacustre; in Oregon, 26 different solutions were sprayed on R. bracteosum, R. sanguineum and R. triste and in California, [illegible] formulae were tested on R. roezli, R. nevadense and R. cereum. While definite data on the effect of these sprays cannot be recorded until 1934, late season observations indicate that complex Z is more effective than complex Y on Ribes in all three states.

c. Laboratory Investigations. A comprehensive investigative program has been continued at Berkeley, California to solve pertinent problems of a chemical, physiological and morphological nature.

2. Experimental Application of Ribicides.

41 solutions were sprayed on 141 plots at Clarkia, Idaho to test the effectiveness of various sprays, to test the relationship between time of application during [illegible] and effectiveness of sprays and to determine seasonal effect on toxicity of chemicals. Definite results [illegible] be determined in 1934.

D. Studies in Ribes Ecology.

1. Inland Empire - Additional findings of this project are:

On burned plots Ribes germination is almost complete the first year; on unburned plots there is heavy germination the second year as well. There is some germination during each growing season. 50 to 60 per cent of Ribes die out in 3 initial seasons of growth with 2/3 of casualties during first growing season.

Ribes begin fruiting at more advanced age than previous data indicated; a bush fruiting in its third year and a stand fruiting generally in its fifth year are exceptional.

Removal of timber canopy is the only one of the three changes in controlled studies which causes a permanent establishment of Ribes.

In a mature white-pine stand, removal of canopy caused an increase in soil temperature of 10 degrees C. on east slope, 14 degrees C. on west slope; removal of top duff - further increase of 30 degrees C. on east, 20 degrees C. on west slope; removal of basal duff - further increase of 5 degrees C. on east, 10 degrees C. on west slope; light burn on undisturbed duff after removal of canopy - increase of 55 degrees C. on east, 40 degrees C. on west slope. Maximum temperatures from 25 degrees C. to 55 degrees C. reached following clear-cut logging, 16 degrees C. to 45 degrees C. on partial-cutting areas. Sustained temperatures exceeding 25 degrees C. are unusual in partial-cutting areas except in most open parts.

2. California. A number of plot studies were initiated which require further checking before definite conclusions can be drawn. Findings in 1929 are: (1) brush-pile burns do not have any marked effect on a Ribes stand; (2) after logging there is a period of 1 or 2 years before heavy germination takes place, then maximum germination continues for 2 to 3 years after which there is a rapid decline; (3) data on hand at present indicate that there is no large storage of seed in the soil over a long period; (4) soil disturbance is a factor in Ribes germination only when other conditions are favorable.

3. Oregon. (1) *R. klamathense* requires a moist habitat for seedlings to become established; (2) ecesis of some species, *R. cruentum* and *R. lobbii* seems to have taken place during certain favorable seasons rather than each year.

III. Application of Local Control.

A. Control Reconnaissance.

California - The preliminary survey of the sugar-pine forests was initiated on the Lassen National Forest where reconnaissance was done on 117,927 acres at a cost of $.0289 per acre.

On burned plots Ribes germination is almost complete [illegible] first year; on unburned plots there is heavy germination the second [illegible] as well. There is some germination during each growing season. [illegible] 60 per cent of Ribes die out in 3 initial seasons of growth [illegible] of casualties during first growing season.

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In a mature white-pine stand, removal of canopy causes an increase in soil temperature of 10 degrees C. on east slope, 14 degrees C. on west slope; removal of top duff - further increase of 30 degrees C. on east, 20 degrees C. on west slope; removal of basal duff - further increase of 6 degrees C. on east, 10 degrees C. on west slope; light burn on undisturbed duff after removal of canopy - increase of 55 degrees C. on east, 44 degrees C. on west slope. Maximum temperatures from 25 degrees C. to 55 degrees C. [illegible] following clear-cut logging, 15 degrees C. to 45 degrees C. on partial-cutting areas. Sustained temperatures exceeding 25 degrees C. are unusual in partial-cutting areas except in most open spots.

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III. Application of Local Control.

A. Control Reconnaissance.

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B. Ribes Eradication on Federal Lands.

Power Spraying - Clearwater National Forest. Development of power spraying indicates that this type of work may be carried on efficiently and economically on areas with heavy concentrations of Ribes. 742 acres of stream type were worked at a cost of $12.85 per acre. 11,150 acres of white-pine type were protected at an average cost of $.89 per acre for protection.

C. Ribes Eradication - Savenac Nursery.

At a cost of $13.675 per acre work was completed on 244.4 acres of stream type including 40 acres on St. Regis River which were cleared by fire.

D. Ribes Eradication in California.

On the Plumas National Forest 472,406 Ribes, 129.1 per acre, were eradicated from 3,660.6 acres at a cost of $3.49 per acre.

E. Ribes Eradication in Oregon.

1. Still Creek - 6,903 Ribes pulled from 454.4 acres; 1,674 bushes eradicated with chemicals from 5.6 acres. A total of 460 acres worked for protection of Forest Service planting.

2. Peavy Arboretum - Protected by eradication of 1,661 Ribes from 396 acres.

F. Cooperative Ribes Eradication.

1. Clearwater Timber Protective Association - Ribes eradicated from 1,835.6 acres of stream type at cost of $12.22 per acre. A high degree of protection provided to 21,500 acres of white pine at an average cost of $1.04 per acre.

2. Potlatch Timber Protective Association - Stream type Ribes eradicated from 3,099.4 acres at a cost of $6.65 per acre affording protection to 57,010 acres of white pine at an average cost of $0.36 per acre for the high degree of protection provided by stream-type eradication.

G. Administrative Inspection.

Efficiency of work on Clearwater Timber Protective Association lands was found to average 98.3 per cent; on the Potlatch Timber Protective Association lands 99.2 per cent based on live stem killed. At Savenac Nursery 3,744 feet of live stem per acre were left after 1928 eradication; 888 feet of live stem per acre after eradication in 1928 and 1929. On an area on the Kaniksu National Forest eradicated in 1926, re-eradicated in 1928, checkers found that in stream type 1,671 feet of live stem per acre

were left after first eradication and 208 feet per acre after second eradication; in upland types 20 feet of live stem per acre were left after first eradication and nothing left after re-eradication.

IV. Field Studies and Collection of Field Data.

A. Spread of the Rust.

1. New Pine Infections - Idaho - Clearwater County, 3 centers - one at junction of Elk and Deep Creeks and one at junction of Three Bear and Long Meadow Creeks, both in the vicinity of Elk River and one on North Fork of Reed's Creek near Headquarters; Shoshone County, on Middle Fork of St. Maries River near Clarkia. Oregon - Hood River County on Eagle Creek and on Herman Creek; Wasco County on Beaver Creek and Clackamas County on Salmon River.

2. New Ribes Infections - Montana - Mineral County, 9 miles northeast of Haugan. Oregon - Jefferson County on Metolius River, Marion County on Devils Creek near Breitenbush and Curry County near Port Orford.

B. Effectiveness of Control - Plot Studies.

Newman Lake, Idaho - Rate of increase in number of cankers of 1927 wave over 1923 wave of infection was in ratio of 1.2 to 1; infection chargeable to 3,155 feet of live stem of *R. inerme* and 2,118 feet of live stem of *R. lacustre* per acre. *R. inerme* eradicated in 1929 to study effect of *R. lacustre* in intensification of disease.

Long Meadow Creek, Idaho - 27 feet of live stem of *R. viscosissimum* and 1,881 feet of live stem of *R. lacustre* per acre have resulted in infection of 5 per cent of pines since 1923.

Rhododendron, Oregon - 13.5 per cent of pines infected since disease became established in 1923, as result of association with 1,071 feet of Ribes live stem per acre (*R. bracteosum* - 419 feet, *R. sanguineum* - 125 feet and *R. lacustre* - 527 feet).

C. Pre-eradication.

1. Idaho - A pre-eradication survey was made on the stream type of 127,000 acres of white-pine type on Federal and private lands as follows: Clearwater National Forest, 35,000 acres; Clearwater Timber Protective Association 32,000 acres and Potlatch Timber Protective Association 60,000 acres.

2. California - In preparation for the 1930 field season pre-eradication work was done on 3,200 acres in the Rush Creek area of the Plumas National Forest.

V. Educational Work.

Through the media of talks and papers, demonstration material and specimen mounts information on the work of all projects has been disseminated to administrators of forest land, educational institutions and the general public in order to build up general interest in and support of the control program.